Balnaves Plug and Abandonment Environment Plan

Revision 2
November 2021

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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 (Cth) (referred to as the Environment Regulations), is operator of the Balnaves Field.

Woodside ceased production from the Balnaves Field in 2016. The Floating Petroleum Storage and Offloading (FPSO) Armada Claire and all other Balnaves infrastructure, apart from the four wells and six Disconnectable Turret Mooring (DTM) anchors, were removed from the field. The plug and abandonment of wells is the final decommissioning activity for Woodside in regard to the Balnaves field and the six buried DTM anchors will remain buried below the seabed.

Woodside proposes to undertake the following activities within Petroleum Licence Area WA-49-L:

- permanently plug and abandon the four Balnaves wells using a moored Mobile Offshore Drilling Unit (MODU)
- remove the well infrastructure above the mudline; and
- inspection, maintenance and repair (IMR) activities to ensure integrity of well infrastructure until decommissioning activities are completed.

These activities will hereafter be referred to as the Petroleum Activities Program and form the scope of this Environment Plan (EP).

A more detailed description of the activities is provided in **Section 3**.

This EP has been prepared as part of the requirements under the Environment Regulations, as administered by the National Offshore Petroleum Safety and Environmental Management Authority (NOPSEMA). In accordance with the requirements of Regulation 19 of the Environment Regulations, Woodside has submitted this EP as a revision to the Balnaves Operations Cessation EP to NOPSEMA at least 14 days prior to the end of the 5 year period from the original acceptance under Regulation 11 of the Environment Regulations (i.e. 20 July 2016, NOPSEMA reference A493506: ID3576).

1.2 Defining the Petroleum Activity

The Petroleum Activities Program to be undertaken in Permit Area WA-49-L, permanent plugging and abandonment of the wells and removal of well infrastructure above the mudline 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 (ESD) (as defined in Section 3A of the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* [EPBC Act]).

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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 the activities that define the Petroleum Activities Program, as described in **Section 3**. The spatial boundary, Operational Area, of the Petroleum Activities Program is defined as 4000 m radius around each well.

This EP addresses potential environmental impacts from planned activities and any potential unplanned risks that originate from within the Operational Area. Transit to and from the Operational Area by the Mobile Offshore Drilling Unit (MODU) and project vessels, as well as port activities associated with these vessels, are not within the scope of this EP. Vessels supporting the Petroleum Activities Program operating outside the Operational Area (e.g. transiting to and from port) are subject to all applicable maritime regulations and other requirements and are not managed by this EP.

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 3.3**
A description of the receiving environment	**Section 4**
A description of the activity	**Section 3**
Details of the environmental impacts and risks	**Section 6**
The control measures for the activity	**Section 6**
The arrangements for ongoing monitoring of the titleholder's environmental performance	**Section 7.5**
Response arrangements in the oil pollution emergency plan	**Section 7.9**
Consultation already undertaken and plans for ongoing consultation	**Section 5**
Details of the titleholder's nominated liaison person for the activity	**Section 1.8**

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**.

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Table 1-2: EP process phases, applicable Environment 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 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(c): demonstrates that the environmental impacts and risks of the activity will be of an acceptable level			
Regulation 10A(d): provides for appropriate environmental performance outcomes, environmental performance standards and measurement criteria	Regulation 13(7): Environmental performance outcomes and standards	Environmental Performance Objectives (EPOs) Environmental Performance Standards (EPSs) Measurement Criteria (MC)	**Section 6**
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 – per Table 7-4) 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	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;	No activity, or part of the activity, undertaken in any part of a declared World Heritage property	**Section 3** **Section 4** **Section 6**

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Criteria for acceptance	Content Requirements/Relevant Regulations	Elements	Section of EP
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.		
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**
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 7.8**

1.7 Description of the Titleholder

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

Woodside is Australia's leading natural gas producer. Woodside's operations are characterised by strong safety and environmental performance in remote and challenging locations. Wherever Woodside works, it is committed to living its values of integrity, respect, working sustainably, discipline, excellence, and working together.

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 Project, 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

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customers, partners, co-venturers, governments, and communities. 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

E: feedback@woodside.com.au

ACN: 130 391 365

1.8.2 Nominated Liaison Person

Daniel Clery

Corporate Affairs Manager

11 Mount Street

Perth, Western Australia

T: 08 9348 4000

E: feedback@woodside.com.au

1.8.3 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

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advice on: how activities or tasks may be performed; information that may be taken into consideration; or, how to use tools and systems.

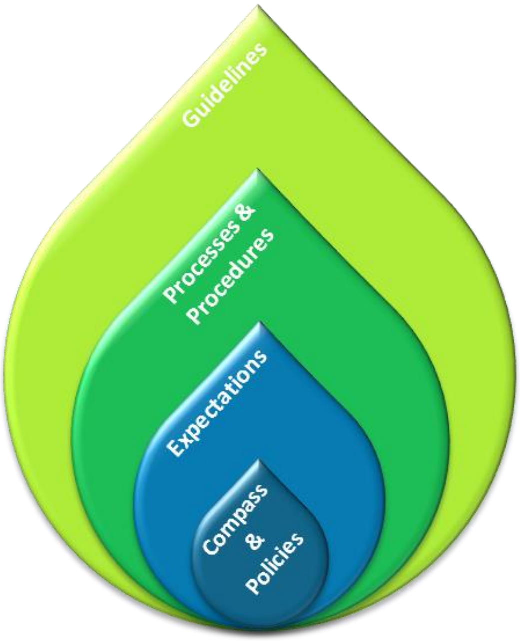

Figure 1-1: The four major elements of the WMS Seed

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.

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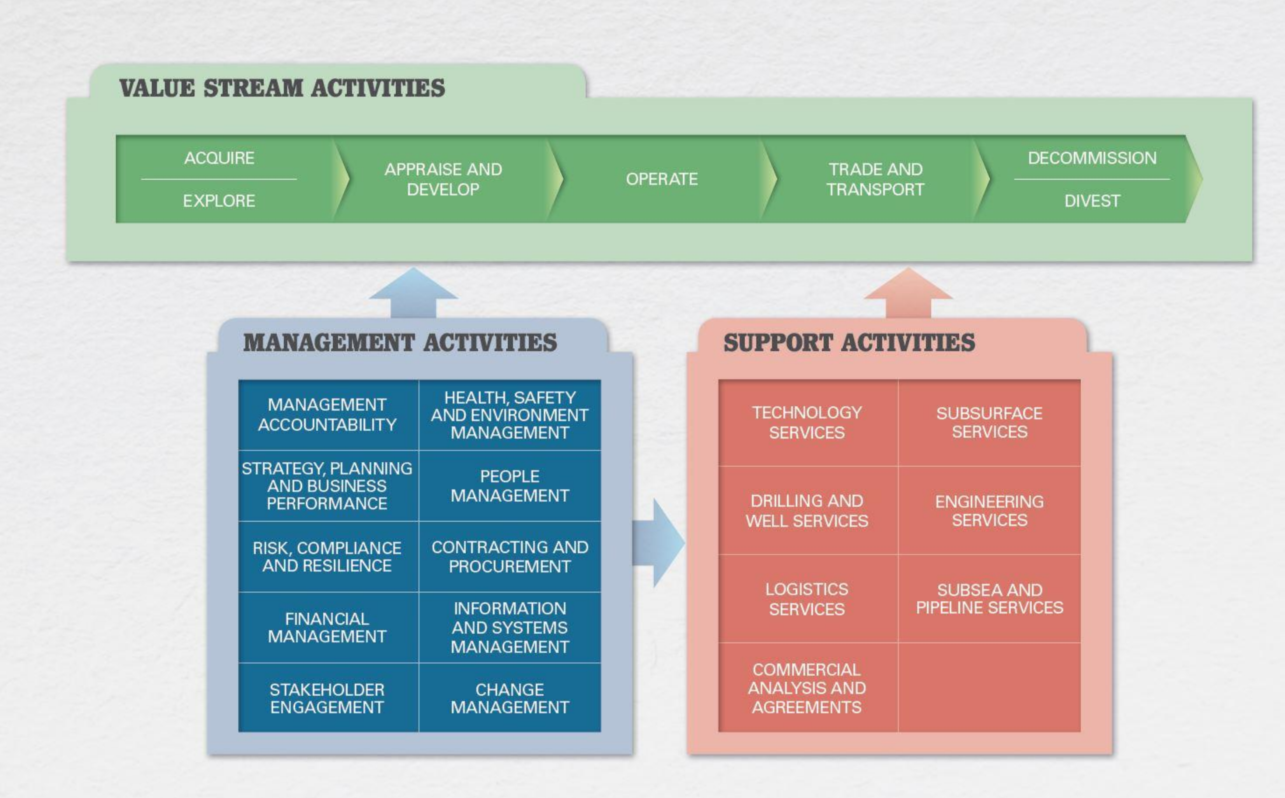

Figure 1-2: The WMS business process hierarchy

1.9.1 Health, Safety, Environment and Quality Policy

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 *Environment Protection Act 1986* as the activity does not occur on State land or within State Waters.

1.10.1 Offshore Petroleum and Greenhouse Gas Storage Act 2006

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 objective of the act is to provide a regulatory framework for petroleum exploration and recovery, greenhouse gas activities in offshore areas.

Due to this being the final EP for the Balnaves Development, the relevant requirements in Section 270 and 572 of the Act are detailed in **Table 1-3**.

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Table 1-3: Relevant requirements of the OPGGS Act 2006

Section Number	Relevant Requirement	Relevant Section of the EP
Section 270 – Consent to surrender title[1]		
3	The Joint Authority may consent to the surrender sought by the application only if the registered holder of the permit, lease or licence:	
	c) has: (i) to the satisfaction of NOPSEMA, removed or caused to be removed from the surrender area (defined by subsection (7)) all property brought into the surrender area by any person engaged or concerned in the operations authorised by the permit, lease or licence; or (ii) made arrangements that are satisfactory to NOPSEMA in relation to that property; and	**Section 3.13**
	d) has, to the satisfaction of NOPSEMA, plugged or closed off all wells made in the surrender area by any person engaged or concerned in the operations authorised by the permit, lease or licence; and	**Section 3.11**
	e) has provided, to the satisfaction of NOPSEMA, for the conservation and protection of the natural resources in the surrender area; and	Not applicable Activities will be undertaken to inform future requirements (**Section 3.13.3** and **3.13.4**)
	f) has, to the satisfaction of NOPSEMA, made good any damage to the seabed or subsoil in the surrender area caused by any person engaged or concerned in the operations authorised by the permit, lease or licence;	
Section 572 - Maintenance and removal of property etc. by titleholder		
2	A titleholder must maintain in good condition and repair all structures that are, and all equipment and other property that is: (a) in the title area; and (b) used in connection with the operations authorised by the permit, lease, licence or authority.	**Section 3.10.8**
3	A titleholder must remove from the title area all structures that are, and all equipment and other property that is, neither used nor to be used in connection with the operations: (a) in the title area; and (b) used in connection with the operations authorised by the permit, lease, licence or authority.	**Section 3.13**
7	This section has effect subject to: (a) any other provision of this Act; and (b) the regulations; and (c) a direction given by NOPSEMA or the responsible Commonwealth Minister under: (i) Chapter 3; or (ii) this Chapter; and (d) any other law.	**Section 3.13.2**

1. Balnaves is one of several petroleum activities in the WA-49-L title area. This EP is intended to inform the requirements under s270 in relation to the Balnaves Development to enable consent to be granted for application to surrender the title, once all petroleum activities have ceased for all petroleum activities in the future.

Under the OPGGS Act, 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:

- carried out in a manner consistent with the principles of ESD

- carried out in a manner by which the environmental impacts and risks of the activity will be reduced to ALARP
- carried out in a manner by which the environmental impacts and risks of the activity will be of an acceptable level.

1.10.2 Environment Protection and Biodiversity Conservation Act 1999

One of the objectives EPBC Act is to protect and manage nationally and internationally important flora, fauna, ecological communities and heritage places in Australia. These are defined under Part 3 of the Act as “Matters of National Environmental Significance” (MNES).The EPBC Act sets a regime which aims to ensure actions taken on (or impacting upon) Commonwealth land or waters are consistent with the principles of Ecologically Sustainable Development (ESD). When a person proposes to take an action that they believe may need approval under the EPBC Act, they must refer the proposal to the Commonwealth Minister for Environment.

In relation to offshore petroleum activities in Commonwealth waters, in accordance with the “Streamlining Offshore Petroleum Approvals Program (the Program)” requirements under the Act are now administered by NOPSEMA, commencing February 2014. The Program requires any offshore petroleum activities, authorised by the OPGGS Act to be conducted in accordance with an accepted EP. The definition of ‘environment’ in the Program covers all matters protected under Part 3 of the Act.

1.10.2.1 Offshore Project Approval

The Balnaves Condensate Field Development was referred for assessment under the EPBC Act in 2011 (2011/6188). A decision by the Environment Minister determined that the action is not a controlled action, provided it is undertaken in a particular manner. The measures / conditions that are considered relevant to the scope of this EP are provided in **Table 1-4.**

Table 1-4: Conditions from EPBC 2011/6188 relevant to the Petroleum Activities Program

Condition Number	Condition	Relevant Section of the EP
1	The Environment Plan (inclusive of the Oil Spill Contingency Plan) as described in the referral must be accepted by the National Offshore Petroleum Safety and Environmental Management Authority prior to the proposed action.	This EP
2	The Well Operations Management Plan as described in the referral must be accepted by the National Offshore Petroleum Safety and Environmental Management Authority prior to the proposed action commencing.	**Section 6.7.2**
3	The Environment Plan (inclusive of the Oil Spill Contingency Plan) and the accepted Well Operations Management Plan as described in components 1 and 2 must be implemented	**Section 7**
4	The following measures must be adhered to and included in the plans described in component 1 above:	
	a. All infrastructure and materials above the seabed from the Balnaves facility will be removed.	This EP; **Section 3.13**
	b. All vessels must not be refuelled within 12 nautical miles of the North and South Muiron Islands, Montebello Islands, Lowendal Islands and Barrow Island (as defined by lowest astronomical tide), unless refuelling is to occur in a port or harbour (e.g. Exmouth Boat Harbour).	**Section 3.10.4**

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Condition Number	Condition	Relevant Section of the EP
	c. Refuelling of all vessels associated with the action must take place between sunrise or sunset, unless otherwise specified in the Environment Plan.	**Section 3.10.4; 6.7.5**

1.10.2.2 Recovery Plans and Threat Abatement Plans

Under s139(1)(b) of the EPBC Act, the Environment Minister must not act inconsistently with a recovery plan for a listed threatened species or ecological community or a threat abatement plan for a species or community protected under the Act. Similarly, under s268 of the EPBC Act:

"A Commonwealth agency must not take any action that contravenes a recovery plan or a threat abatement plan."

In relation to offshore petroleum activities in Commonwealth waters, these requirements are now administered by NOPSEMA in accordance with commitments set out in the Program. Commitments relating to listed threatened species and ecological communities under the Act are included in the Program Report (Commonwealth of Australia, 2014):

- NOPSEMA will not accept an Environment Plan that proposes activities that will result in unacceptable impacts to a listed threatened species or ecological community.
- NOPSEMA will not accept an Environment Plan that is inconsistent with a recovery plan or threat abatement plan for a listed threatened species or ecological community.
- NOPSEMA will have regard to any approved conservation advice in relation to a threatened species or ecological community before accepting an Environment Plan.

1.10.2.3 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 (s362 of the EPBC Act). Relevant AMPs are listed in **Section 4.3** and described in **Appendix H**. 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 nonextractive activities unless authorised for research and monitoring.

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- 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.

1.10.2.4 World Heritage Properties

Australian World Heritage management principles are prescribed in Schedule 5 of the EPBC Regulations 2000. Management principles that are considered relevant to the scope of this EP are provided in **Table 1-5**.

Table 1-5: Relevant Management Principles under Schedule 5—Australian World Heritage management principles of the EPBC Act.

Number	Principle	Relevant Section of the EP
3	Environmental impact assessment and approval 3.01 This principle applies to the assessment of an action that is likely to have a significant impact on the World Heritage values of a property (whether the action is to occur inside the property or not). 3.02 Before the action is taken, the likely impact of the action on the World Heritage values of the property should be assessed under a statutory environmental impact assessment and approval process. 3.03 The assessment process should: (a) identify the World Heritage values of the property that are likely to be affected by the action; and (b) examine how the World Heritage values of the property might be affected; and (c) provide for adequate opportunity for public consultation. 3.04 An action should not be approved if it would be inconsistent with the protection, conservation, presentation or transmission to future generations of the World Heritage values of the property. 3.05 Approval of the action should be subject to conditions that are necessary to ensure protection, conservation, presentation or transmission to future generations of the World Heritage values of the property. 3.06 The action should be monitored by the authority responsible for giving the approval (or another appropriate authority) and, if necessary, enforcement action should be taken to ensure compliance with the conditions of the approval.	3.01 and 3.02: Assessment of significant impact on World Heritage values is included in **Section 6**. Principles are met by the submitted EP. 3.03 (a) and (b): World Heritage values are identified in **Section 4** and considered in the assessment of impacts and risks for the Petroleum Activity in **Section 6**. 3.03 (c): Relevant stakeholder consultation and feedback received in relation to impacts and risks to the Ningaloo World Heritage Property are outlined in **Section 5**. 3.04, 3.05 and 3.06: Principles are considered to be met by the acceptance of this EP.

Note that Section 1 – General Principles and 2 – Management Planning of Schedule 5 are not considered relevant to the scope of this EP and, therefore, have not been included.

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2. ENVIRONMENT PLAN PROCESS

2.1 Overview

This section outlines the process taken by Woodside to prepare this EP, once the activity was defined as a petroleum activity. The process describes the activity, the existing environment, followed by the environmental risk management methodology used to identify, analyse and evaluate risks to meet ALARP levels and acceptability requirements, and develop environmental performance outcomes (EPOs) and environmental performance standards (EPSs). This section also describes Woodside's risk management methodologies as applied to implementation strategies for the activity.

Regulation 13(5) of the Environment Regulations requires the detailing of environmental impacts and risks, and evaluation 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 include potential emergency and accidental events:

- **Planned activities** have the potential for inherent environmental impacts.
- **Environmental risks** are unplanned events with the potential for environmental impact (termed risk 'consequence').

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

2.2 Environmental Risk Management Methodology

2.2.1 Woodside Risk Management Process

Woodside recognises that risk is inherent to its business and that effective management of risk is vital to delivering on company objectives, success and continued growth. Woodside is committed to managing all risk 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 these 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 ISO 31000. Woodside's WMS risk management procedures, guidelines and tools provide guidance of specific techniques for managing risk, tailored for particular areas of risk within certain business processes. Procedures applied for environmental risk management include:

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

The risk management methodology provides a framework to demonstrate that 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 2.2** to **2.11**.

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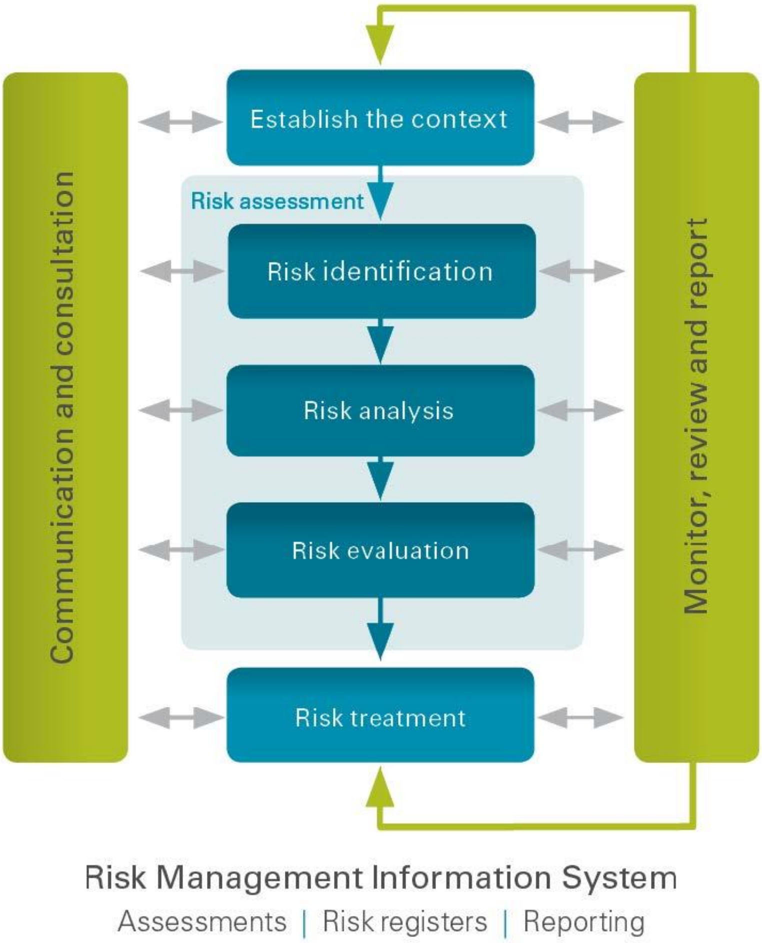

Figure 2-1: Woodside's risk management process

2.2.2 Health, Safety and Environment Management Procedure

The Health, Safety and Environment Management Procedure provides the structure for managing health, safety and environment (HSE) risks and impacts across Woodside, defines the decision authorities for company-wide HSE management activities and deliverables, and supports 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 to meet the required environment, health and social standards by ensuring impact assessments are undertaken 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.

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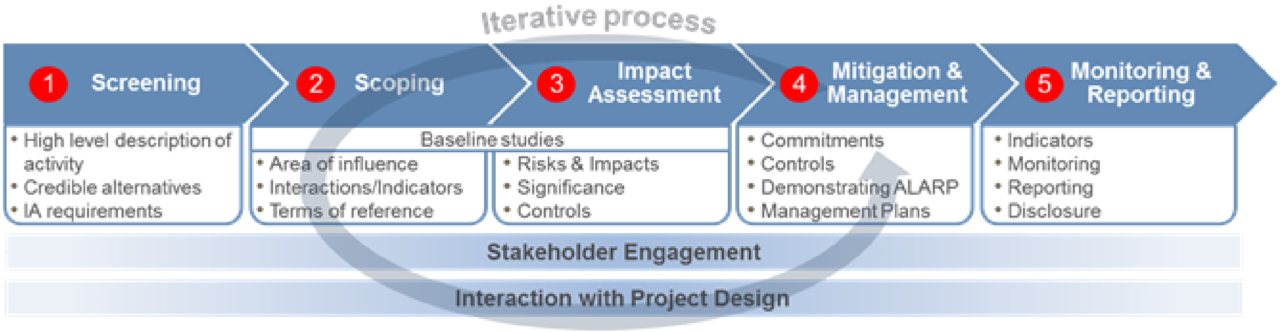

Figure 2-2: Woodside's impact assessment process

2.3 Environment Plan Process

Figure 2-3 illustrates the EP development process. Each element of this process is discussed further in **Sections 2.5** to **2.10**.

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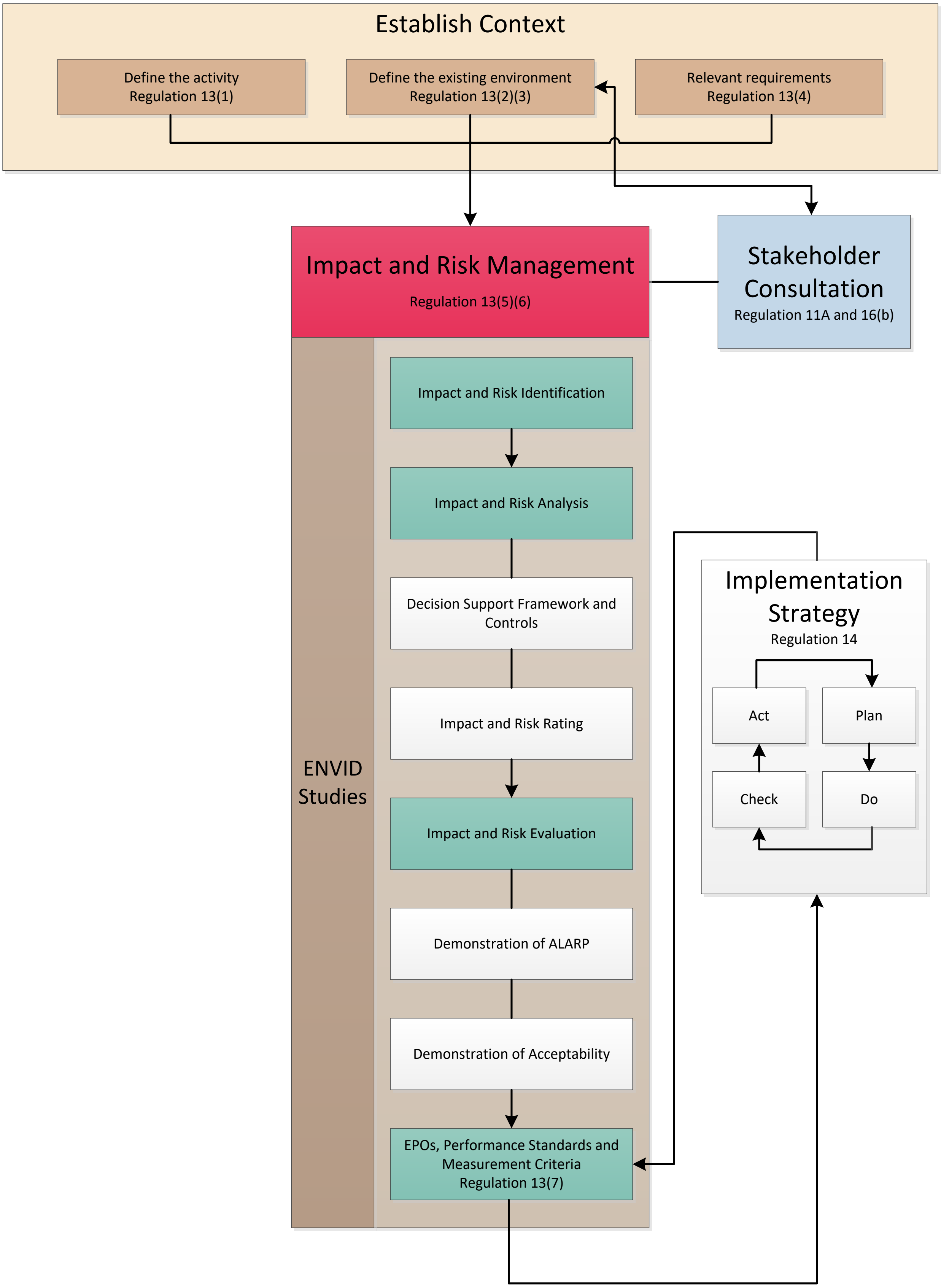

Figure 2-3: Environment Plan development process

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 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 is referred to as the Petroleum Activities Program.

2.4.2 Define the Existing Environment

The context of the existing environment is described and determined by considering the nature and scale of the activity (size, type, timing, duration, complexity, and intensity of the activity), as described in **Section 3**. The purpose is to describe the existing environment that may be impacted by the activity, directly or indirectly, by planned or unplanned[2] events.

The Existing Environment (**Section 4**) is structured into subsections defining the physical, biological, socioeconomic and cultural attributes of the area of interest, in accordance with the definition of environment in Regulation 4(a) of the Environment Regulations. These subsections make particular reference to:

- The environmental, and social and cultural consequences as defined by Woodside (refer to **Table 2-1**), which address key physical and biological attributes, as well as social and cultural values of the existing environment. These consequence definitions are applied to the impact and risk analysis (refer **Section 2.2**) and rated for all planned and unplanned activities. Additional detail is provided for unplanned hydrocarbon spill risk evaluation.
- EPBC Act 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 (and associated sources of environmental risk). This considers the Operational Area and wider environment that may be affected (EMBA), as determined by the hydrocarbon spill risk assessments presented in **Section 6.7.1**. MNES, as defined within the EPBC Act, are addressed through Woodside's impact and risk assessment (**Section 6**).
- Relevant values and sensitivities, which may include world or national heritage listed areas, listed threatened species or ecological communities, listed migratory species, or sensitive values.

By grouping potentially impacted environmental values by aspect (as presented in **Table 2-1)**, the presentation of information about the receiving environment is standardised. This information is then consistently applied to the risk evaluation section to provide a robust approach to the overall environmental risk evaluation and its documentation in the EP.

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

[2] For each source of risk, the credible worst-case scenario in conjunction with impact thresholds is used to determine the spatial extent of the EMBA. 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.

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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	Socioeconomic

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, and are presented in **Appendix B**.

The Corporate Health, Safety, Environment and Quality Policy is presented in **Appendix A**.

2.5 Impact and Risk Identification

Relevant environmental aspects and hazards were identified that 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 and environment identification studies (e.g. HAZID/ENVID), PSRA processes, reviews, and desktop studies associated with the Petroleum Activities Program. Impacts, risks and potential consequences were 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 in this EP.

The ENVID was undertaken by multidisciplinary teams comprising relevant operational and environmental personnel with sufficient breadth of knowledge, training and experience to reasonably assure that risks and impacts were identified and their potential environmental consequences 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 identified as not applicable (not credible) were removed from the assessment.

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

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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	Socioeconomic	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, as well as considering previous risk assessments for similar activities, relevant studies, past performance, external stakeholder consultation feedback, and the existing environment.

These key steps were undertaken for each identified risk during the risk assessment:

- identify the decision type in accordance with the decision support framework
- identify appropriate control measures (preventive and mitigation) 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 the use of a decision support framework based on principles set out in the Guidance on Risk Related Decision Making (Oil and Gas UK 2014). This concept was applied during the ENVID, or equivalent processes during historical design decisions, to determine the level of supporting evidence that may be required to draw sound conclusions regarding risk level and whether the risk is acceptable and ALARP (**Figure 2-4**). Application of the decision support framework confirms:

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

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

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

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2.6.1.1 Decision Type A

Decision Type A risks and impacts are well understood and established practice. They are generally recognised as good industry practice and are often embodied in legislation, codes and standards, and use professional judgment.

2.6.1.2 Decision Type B

Decision Type B risks and impacts 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 that 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

Decision Type C risks and impacts typically have significant risks related to environmental performance. Such risks typically involve greater complexity and uncertainty, therefore requiring the adoption of the precautionary approach. The risks may result in significant environmental impact, significant project risk/exposure, or may elicit negative stakeholder concerns. For these risks or impacts, 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.

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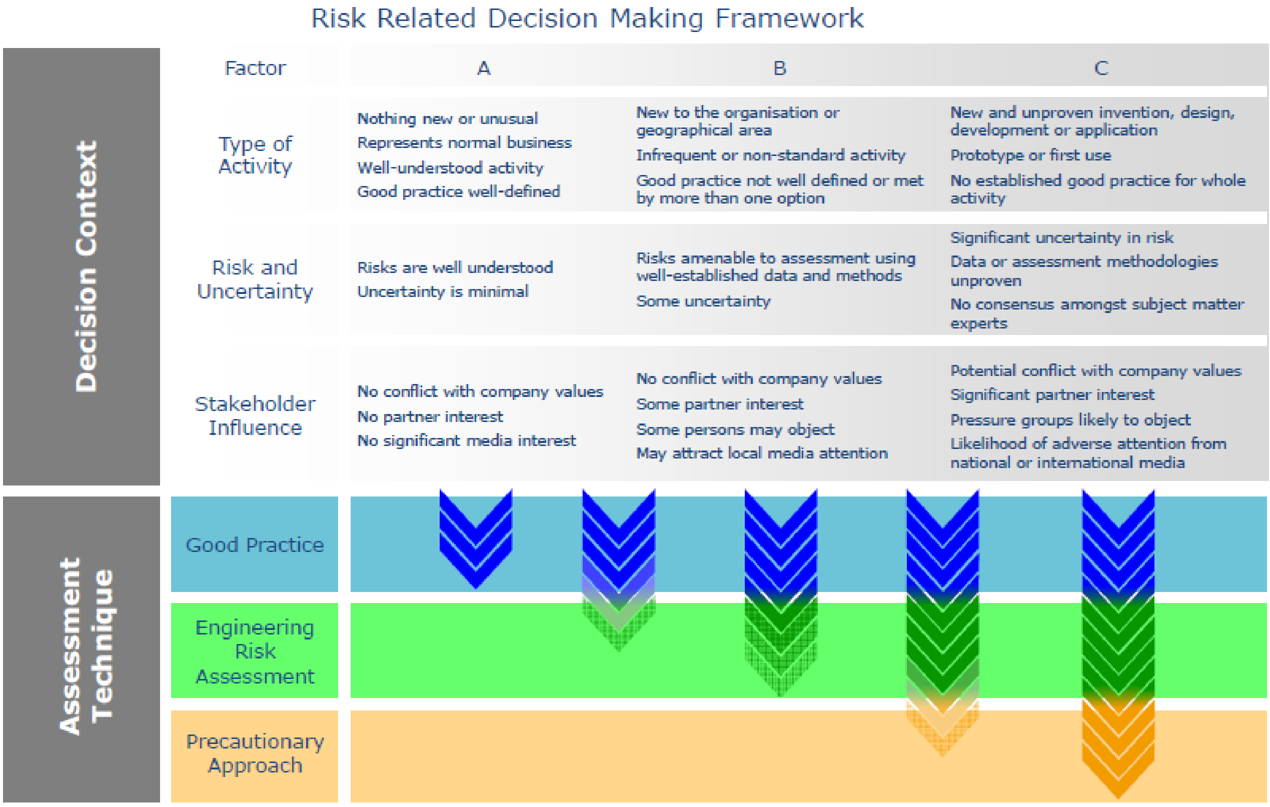

Risk Related Decision Making Framework

	Factor	A	B	C
Decision Context	Type of Activity	Nothing new or unusual Represents normal business Well-understood activity Good practice well-defined	New to the organisation or geographical area Infrequent or non-standard activity Good practice not well defined or met by more than one option	New and unproven invention, design, development or application Prototype or first use No established good practice for whole activity
	Risk and Uncertainty	Risks are well understood Uncertainty is minimal	Risks amenable to assessment using well-established data and methods Some uncertainty	Significant uncertainty in risk Data or assessment methodologies unproven No consensus amongst subject matter experts
	Stakeholder Influence	No conflict with company values No partner interest No significant media interest	No conflict with company values Some partner interest Some persons may object May attract local media attention	Potential conflict with company values Significant partner interest Pressure groups likely to object Likelihood of adverse attention from national or international media

Figure 2-4: Risk-related decision-making framework

Source: Oil and Gas UK (2014)

2.6.1.4 Decision Support Framework Tools

These framework tools are applied, as appropriate, to help identify control measures based on the decision type described above:

- **Legislation, Codes and Standards (LCS)** – identifies the requirements of legislation, codes and standards that are to be complied with for the activity.
- **Good Industry Practice (GP)** – identifies further engineering control standards and guidelines that may be applied by Woodside above that required to meet the LCS.
- **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 identified 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.

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Decision Calibration

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

- **LCS/Verification of Predictions –** Verification of compliance with applicable LCS and/or good industry practice.
- **Peer Review** – Independent peer review of PJs, supported by RBA, where appropriate.
- **Benchmarking –** Where appropriate, benchmarking against a similar facility or activity type or situation that has been deemed 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 are 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** include design measures to prevent or reduce the frequency of the risk event, or 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 if a hazardous event occurs
    - Response Equipment: design measures or safeguards that enable clean-up/response after a hazardous event occurs.
- **Procedures and Administration** includes management systems and work instructions used to prevent or mitigate environmental exposure to hazards.
- **Emergency Response and Contingency Planning** 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**).

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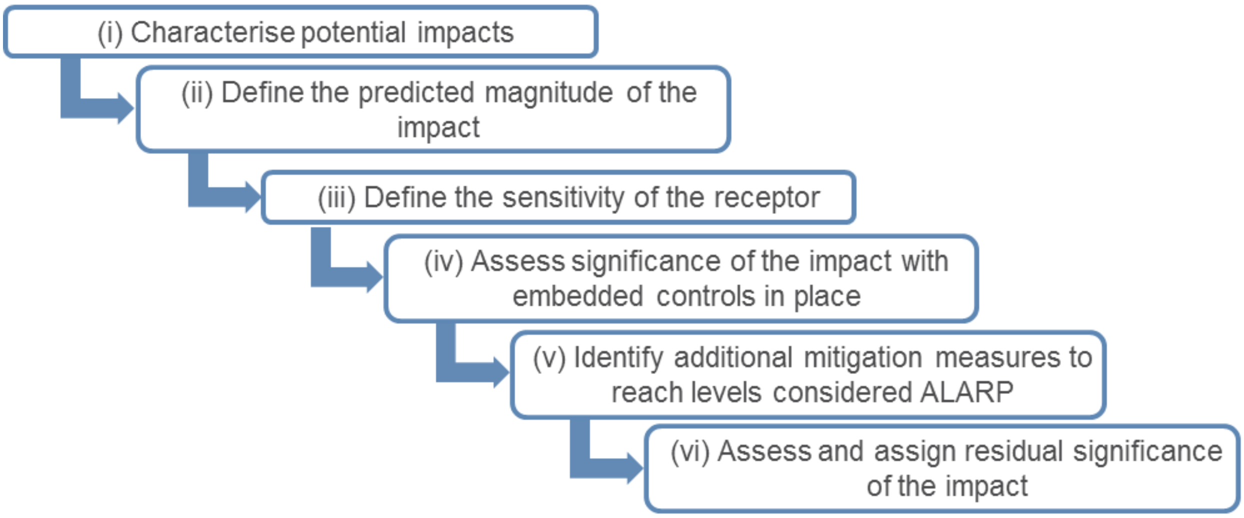

Figure 2-5: Environmental risk and impact analysis

Impacts are classified in accordance with the consequence (**Table 2-3**) outlined in Woodside's Risk Management Procedure and Risk Matrix (**Figure 2-6**). Risks are assessed qualitatively and/or quantitatively in terms of both likelihood and consequence in accordance with this matrix.

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

Table 2-3: Woodside risk matrix (Environment and Social and Cultural) consequence descriptions

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

2.6.3.1 Risk Rating Process

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

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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 done using the steps described in the subsections below.

Select the Consequence Level

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

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 1,000–10,000 years	1 in 100–1,000 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 rating is derived from the consequence and likelihood levels above, in accordance with the Woodside Risk Matrix shown in **Figure 2-6**. A likelihood and risk rating are only applied to environmental risks, not environmental impacts from planned activities.

This risk rating 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.

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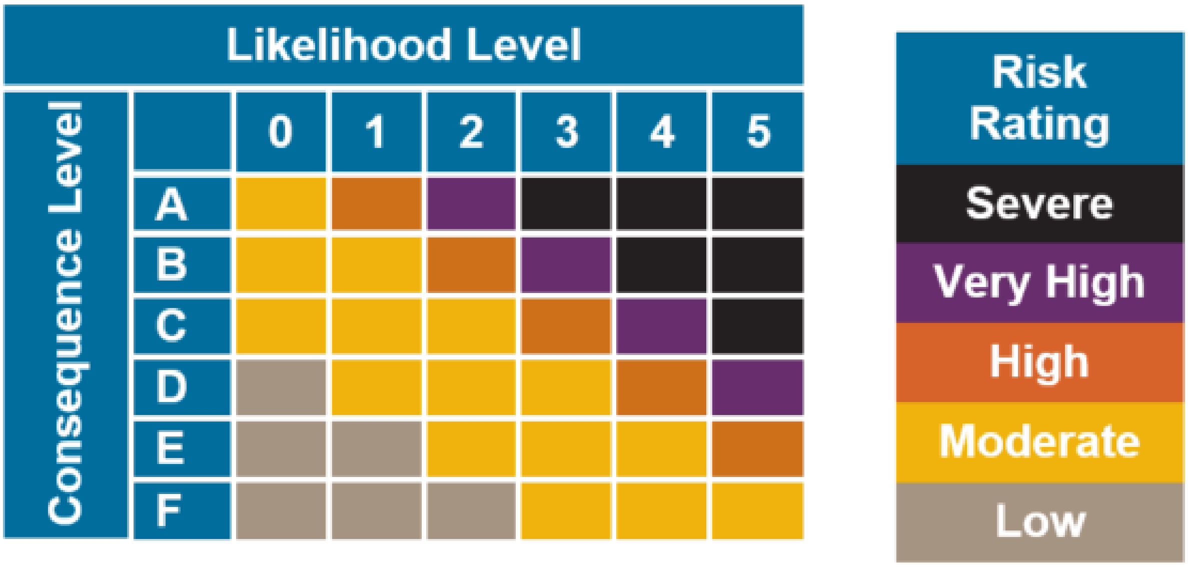

Consequence Level	Likelihood Level					
	0	1	2	3	4	5
A	🟨	🟧	🟪	⬛	⬛	⬛
B	🟨	🟨	🟧	🟪	⬛	⬛
C	🟨	🟨	🟨	🟧	🟪	⬛
D	🟫	🟨	🟨	🟨	🟧	🟪
E	🟫	🟫	🟨	🟨	🟨	🟧
F	🟫	🟫	🟫	🟨	🟨	🟨

Risk Rating
⬛ Severe
🟪 Very High
🟧 High
🟨 Moderate
🟫 Low

Figure 2-6: Woodside risk matrix – risk level

To support ongoing risk management (as a key component of Woodside's Process Safety Management Framework – refer to the implementation strategy in **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 effective on a day-to-day basis. The Current Risk Rating 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 communicating and making visible the risk events and ensures the continual management of risk 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, differing species, persistence, reversibility, resilience, cumulative effects, and variability in severity than safety risks. 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. Evaluation includes considering the:

- Decision Type
- principles of ESD – as defined under the EPBC Act
- internal context – ensuring the proposed controls and risk level are consistent with Woodside policies, procedures and standards (**Section 7** and **Appendix A**)
- external context – the environment consequence (**Section 6**) and stakeholder acceptability (**Section 5**)
- other requirements – ensuring the proposed controls and risk level are consistent with national and international standards, laws and policies.

In accordance with Environment Regulation 10A(a), 10A(b), 10A(c) and 13(5)(b), Woodside applies the process described in the subsections below 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

The descriptions in **Table 2-5** articulate how Woodside demonstrates that different risks, impacts and Decision Types identified within the EP are ALARP.

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

<table>
<tr><th>Risk</th><th>Impact</th><th>Decision Type</th></tr>
<tr><td>Low and Moderate
(below C level consequence)</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:
• identified controls meet legislative requirements, industry codes and standards, applicable company requirements and industry guidelines, or
• further effort towards impact/risk reduction (beyond using opportunistic measures) is not reasonably practicable without sacrifices that are grossly disproportionate to the benefit gained.</td></tr>
<tr><td>High, Very High or Severe
(C+ consequence risks)</td><td>Moderate and above
(A, B, 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) that:
• 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

The descriptions in **Table 2-6** articulate how Woodside demonstrates how different risks, impacts and Decision Types identified within the EP are Acceptable.

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 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 risk reduction (beyond using opportunistic measures) is not reasonably practicable without sacrifices that are grossly disproportionate to the benefit gained.</td></tr>
<tr><td>High, Very High or Severe</td><td>Moderate and above (A, B, C)</td><td>B and C</td></tr>
<tr><td colspan="3">Woodside demonstrates these higher-order risks, impacts and decision types are of an 'Acceptable' level if it can be demonstrated that the predicted levels of impact and/or residual risk, are:
• managed to ALARP (as described in Section 2.7.1)
• meet the following criteria, appropriate to the nature and scale of each impact and risk:
  – 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).
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), acceptability may be required to be conducted separately for key receptors. This is not applicable for risks, given the consequence of an unplanned risk event occurring may not be acceptable and, therefore, acceptability is demonstratedin the context of the residual likelihood of an event occurring.
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</td></tr>
</table>

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Risk	Impact	Decision Type
increasing involvement of senior management in accordance with Woodside's Risk Management Procedure to accept the risk. This includes due consideration of regulatory requirements.		

2.8 Recovery Plan and Threat Abatement Plan Assessment

To support the demonstration of acceptability, a separate assessment is undertaken to demonstrate that the EP is not inconsistent with any relevant recovery plans or threat abatement plans (refer **Section 1.10.2.2**). The steps in this process are:

- identify relevant listed threatened species and ecological communities (**Section 4.5**).
- identify relevant recovery plans and threat abatement plans (**Section 4.5.2**).
- list all objectives and (where relevant) the action areas of these plans, and assess whether these objectives/action areas apply to government, the Titleholder, and the Petroleum Activities Program (**Section 6.8**).
- for those objectives/action areas applicable to the Petroleum Activities Program, identify the relevant actions of each plan, and evaluate whether impacts and risks resulting from the activity are clearly not inconsistent with that action (**Section 6.8**).

2.9 Environmental Performance Outcomes, Environmental Performance Standards, and Measurement Criteria

EPOs, EPSs and measurement criteria (MC) are defined to address the potential environmental impacts and risks. These are explored in **Section 6**.

2.10 Implement, Monitor, 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 program. The strategy is based on the principles of 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
- EPOs and EPSs set out in the EP are met through monitoring, recording, auditing, managing non-conformance, and reviewing
- 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 emergencies or potential emergencies
- arrangements are in place for oil pollution emergencies, to respond to and monitor impacts
- environmental reporting requirements are met, including 'reportable incidents'
- appropriate stakeholder consultation is undertaken throughout the activity.

The implementation strategy is presented in **Section 7**.

2.11 Stakeholder Consultation

A stakeholder assessment is undertaken to identify relevant people (as defined under Regulation 11A of the Environment Regulations) to whom an activity update is issued electronically; reasonable consultation periods are included. Further details and information is provided to any stakeholder if requested.

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A summary and assessment of each stakeholder response is undertaken 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**. A copy of the full text correspondence with relevant people is provided in **Appendix F**.

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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 performed as part of the Petroleum Activities Program under this EP.

3.2 Project Overview

Production from the Balnaves field ceased in March 2016 and all infrastructure associated with the Balnaves facility has been decommissioned and removed from above seabed in the Operational Area, except the wells. There are four wells required to be permanently plugged and abandoned. The Balnaves wells include two oil production wells, one water injection well and one gas injection well. They are currently in a state of preservation.

The Petroleum Activities Program for this EP will include:

- permanently plug and abandon the four Balnaves wells using a moored MODU
- remove the well infrastructure above the mudline; and
- IMR activities to ensure integrity of well infrastructure until decommissioning activities are completed.

Removal of remaining infrastructure and materials (Xmas trees and wellheads) does not include any well equipment or structures installed below the seabed.

An overview of the Petroleum Activities Program is provided in **Table 3-1** and the layout of the Balnaves subsea wells, is provided in **Figure 3-1**.

This is the final activity for the Balnaves field. Upon completion of activities described in this EP, no further decommissioning activities are required.

Table 3-1: Petroleum Activities Program Overview

Item	Description
Title area	WA-49-L
Location	Northern Carnarvon Basin
Water depth	• Operational Area: ~110 to ~160 m
Number of wells	• Two production wells • One water injection well • One gas injection well
Mobile Offshore Drilling Unit (MODU)	• Semi-submersible moored MODU
Vessels	• Subsea support vessel(s) including IMR vessel(s) and anchor handling vessel(s) (AHV) • Two to four activity support vessels, including general supply vessels
Key activities	• IMR activities to prepare for and support plug and abandonment of the wells and maintain infrastructure until it is completely removed. • Permanently plug the four wells for abandonment using a moored MODU. • Removal and recovery of well infrastructure, including Xmas trees and wellheads. • Complete final as-left survey.

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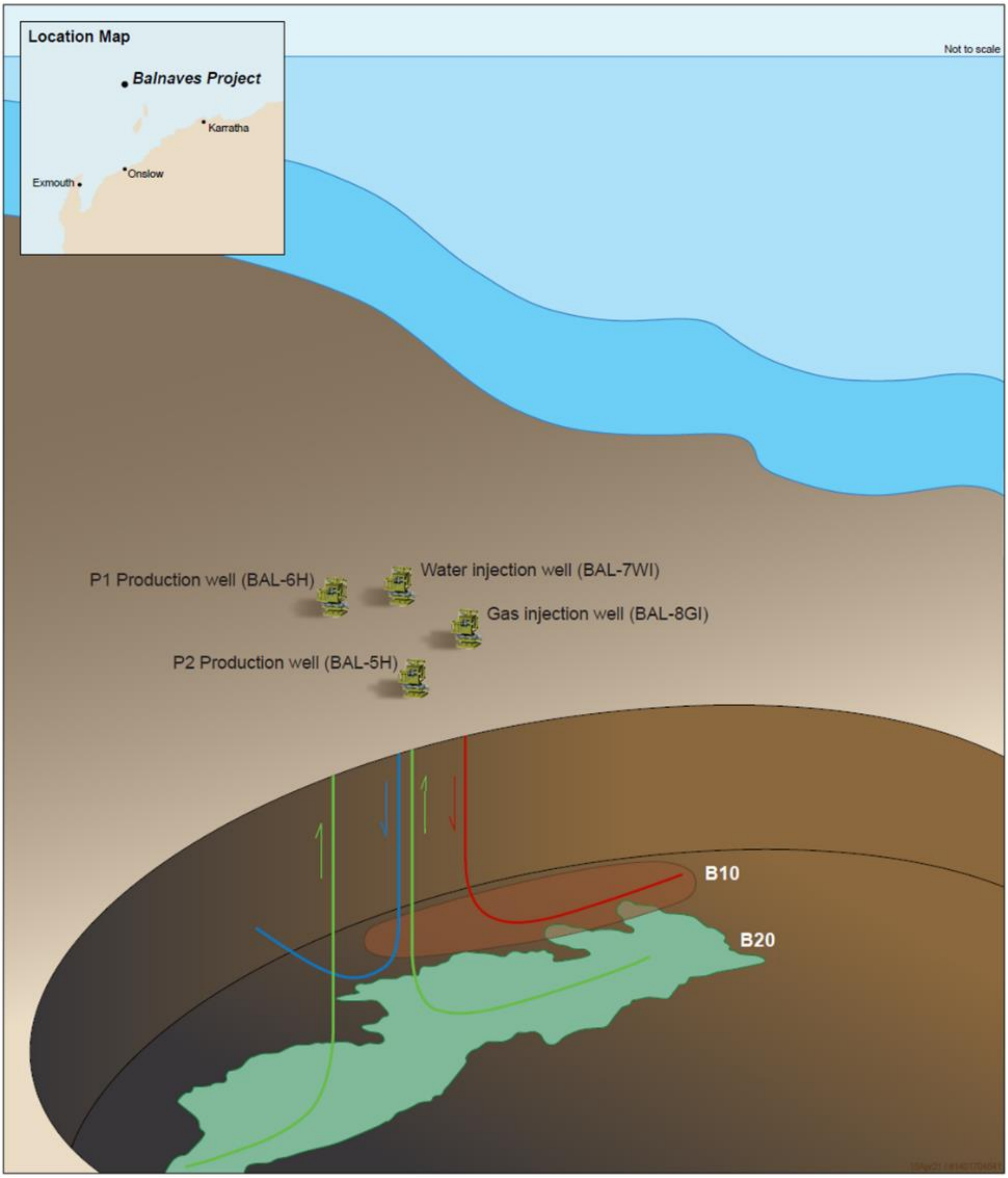

Figure 3-1: Balnaves subsea infrastructure layout

3.3 Location

The Petroleum Activities Program is located in Commonwealth waters in the Northern Carnarvon Basin. WA-49-L is located approximately 169 km north west of Dampier and approximately 48 km north-west of the Montebello Islands (**Figure 3-2**). The approximate location coordinates and water depth of the subsea wells are provided in **Table 3-2**.

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

Subsea Wells	Latitude	Longitude	Water Depth (Approx. In LAT)	Status*
Production 1 well (BAL-6H)	-20° 04’ 12.639’’	115° 11’ 00.641’’	135 m	Suspended
Production 2 well (BAL-5H)	-20° 04’ 14.438’’	115° 11’ 00.267’’	135 m	Suspended
Gas injection well (BAL-8GI)	-20° 04’ 14.007’’	115° 11’ 01.756’’	135 m	Suspended
Water injection well (BAL-7WI)	-20° 04’ 12.867’’	115° 11’ 01.552’’	135 m	Suspended

* At time of EP submission

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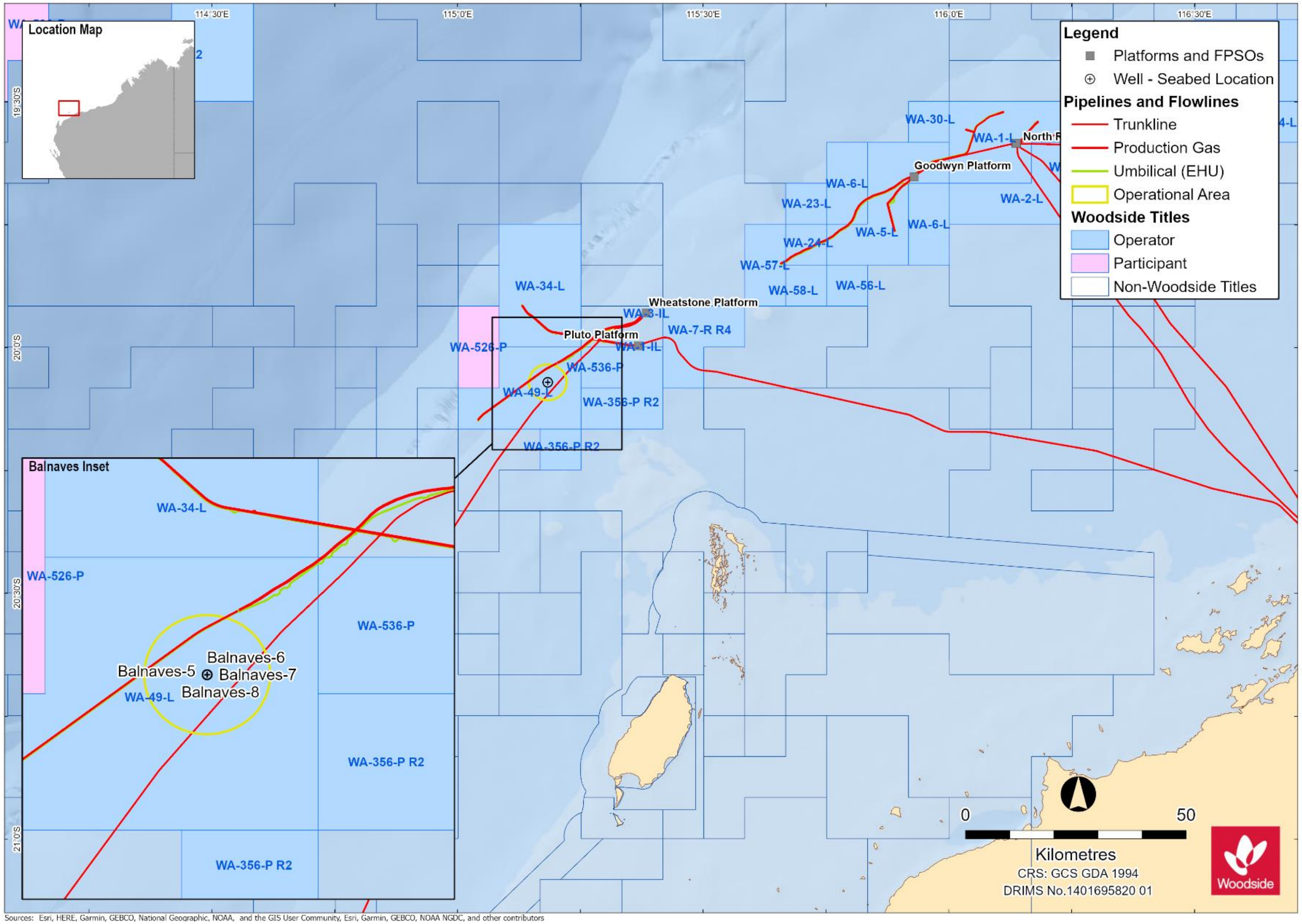

Figure 3-2: Petroleum Activities Program location and Operational Area

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3.4 Operational Area

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

The Operational Area is illustrated in (**Figure 3-2**) and is defined by a 4000 m radius around each well to allow a moored MODU to undertake plugging for abandonment activities. This includes a 500 m exclusion zone (temporary) to manage vessel movements around the MODU during permanent plugging activities and Subsea Support Vessel when undertaking infrastructure removal activities.

3.5 Timing

Permanent plugging for abandonment is targeted to commence in May 2022, however subject to approvals and MODU availability, the commencement of the activity may take place in 2023 or 2024.

The summary of the proposed timing for the Petroleum Activities Program is outlined in **Table 3-3**.

Table 3-3: Proposed timing of the Petroleum Activities Program

Activity	Cumulative duration	Approximate timing
Well and Infrastructure Management Activities		
IMR activities (as described in **Section 3.10.2**)	Ongoing, as needed.	2022-2024
Plugging Activities		
Preparation for permanent abandonment: Xmas tree cleaning and pre-lay MODU anchors as required.	~1 week for Xmas tree preparation and up to 3 weeks to also pre-lay MODU anchors.	Two to four months before permanent plugging in 2022-2024
Permanent abandonment	20 to 60 days per well (between 80 and 240 days for all four wells). Note: Total duration allows for installation of MODU anchors if these were not installed prior; and infrastructure removal if undertaken immediately following permanent plugging.	2022-2024 Plugging activities are planned to be completed between 1 May and 30 October (outside of cyclone season).
Removal and Recovery of Well Infrastructure		
Removal of well infrastructure[1]	Cut and recovery of well infrastructure will take 18 – 36 hours per Xmas tree and wellhead; and up to four weeks for all infrastructure, including a seabed clearance survey.	By end of 2024

[1] *Cutting and recovery of infrastructure will most likely be undertaken by a vessel as a separate field activity to the permanent plugging, but may be completed immediately following plugging (refer to **Section 3.13**).*

When ongoing, activities will be 24 hours per day, seven days per week. Timing and duration of these activities is subject to change due to project schedule requirements, MODU/vessel availability, unforeseen circumstances and weather. Permanent plugging activities are planned to be conducted, and will commence, outside cyclone season (defined as 1 November to 30 April). If the end of permanent plugging is forecast to go beyond 31 October, in order to complete activities, a risk assessment will be undertaken to ensure the risk is managed to ALARP and is acceptable (see **Section 6.5.2**). IMR and infrastructure removal could occur at any time of the year.

3.6 Infrastructure Overview

All infrastructure above the seabed except the Balnaves well infrastructure was removed during the previous phases of Balnaves decommissioning. Six mooring anchors remain buried below the seabed.

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Oil from the Balnaves reservoir was produced through two horizontal wells. The field also includes a horizontal water injection well and a deviated gas injection well, which injected gas into a different reservoir than the production and water injection wells. The layout of the wells is illustrated in **Figure 3-1** and well specifications summarised in **Table 3-4**.

Each well is completed with a subsea Xmas tree incorporating controls for opening and closing the valves to isolate and regulate flow. The primary down-hole safety system is a surface controlled subsurface safety valve (SCSSV) installed on each well in the production tubing about 335-360 m below the mudline. Prior to FPSO sail-away, the SCSSVs on the production and gas injection wells were inflow-tested and passed in accordance with API 14B Performance Standard, these valves were subsequently left closed. The BAL-7WI SCSSV could not be inflow-tested due to hydrostatic conditions (insufficient pressure for the well to flow to seabed).

During subsea infrastructure decommissioning activities, the Xmas tree cavities were filled with a mixture of treated seawater and methanol, pressure capped and tested for integrity. Well integrity verification of the subsea production, gas injector and water injector wells has been completed in accordance with the current in-force Well Operations Management Plan (WOMP). The last ROV inspection was performed in May 2020, during which no anomalies were identified.

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Table 3-4: Description of Balnaves wells

Well	Total Depth Drilled	Drilling Fluids	Wellbore Status	Well Infrastructure
Production 1 well (BAL-6H)	4,248m MDSS / 3,213mTVDSS	The initial sections until the 340mm / 13-3/8" casing shoe were drilled with seawater with high-viscosity sweeps. The section down to the 244mm / 9-5/8" casing shoe at 3,694mMDSS was drilled with NWBM which remains in the annulus of this casing to seabed. This NWBM will have to be remediated during abandonment operations. No NWBM is remaining in other annuli above the Permanent plug installation point. Therefore no NWBM remediation from other annuli is required.	Horizontal Gas-Lifted oil production well with sandscreen lower completion. Well shut-in at Xmas tree with reservoir fluids left in the wellbore.	Horizontal Xmas tree/ Flowbase / 30" LP & 18.3/4" HP wellhead
Production 2 well (BAL-5H)	4248mMDSS/ 3,233mTVDSS	The initial sections until the 340mm / 13-3/8" casing shoe were drilled with seawater with high-viscosity sweeps. The section down to the 244mm / 9-5/8" casing shoe at 3,270mMDSS was drilled with NWBM which remains in the annulus of this casing to seabed. This NWBM will have to be remediated during abandonment operations. No NWBM is remaining in other annuli above the Permanent plug installation point. Therefore no NWBM remediation from other annuli is required.	Horizontal Gas-Lifted oil production well with sandscreen lower completion. Well shut-in at Xmas tree with reservoir fluids left in the wellbore.	Horizontal Xmas tree/ Flowbase / 30" LP & 18.3/4" HP wellhead
Water injection well (BAL-7WI)	4,543mMDSS / 3,306mTVDSS	The initial sections until the 340mm / 13-3/8" casing shoe were drilled with seawater with high-viscosity sweeps. The section down to the 244mm / 9-5/8" casing shoe at 3,267mMDSS was drilled with NWBM which remains in the annulus of this casing to seabed. This NWBM will have to be remediated during abandonment operations. No NWBM is remaining in other annuli above the Permanent plug installation point. Therefore no NWBM remediation from other annuli is required.	Horizontal water injection well with sandscreen lower completion. Well shut-in at the Xmas tree with injection and reservoir fluids left in the wellbore.	Horizontal Xmas tree/ Flowbase / 30" LP & 18.3/4" HP wellhead
Gas injection well (BAL-8GI)	4.687mMDSS / 3,319mTVDSS	The initial sections until the 340mm / 13-3/8" casing shoe were drilled with seawater with high-viscosity sweeps. The section down to the 244mm / 9-5/8" casing shoe at 4,336mMDSS was drilled with NWBM which remains in the annulus of this casing to seabed. This NWBM will have to be remediated during abandonment operations. No NWBM is remaining in other annuli above the Permanent plug installation point. Therefore no NWBM remediation from other annuli is required.	Deviated, cased and perforated gas injection well. Well shut-in at the Xmas tree with injection and reservoir fluids left in the wellbore.	Horizontal Xmas tree/ Flowbase / 30" LP & 18.3/4" HP wellhead

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3.7 Other Property including Exploration Wellheads in the Licence Area

Licence area WA-49-L also includes infrastructure covered under the approved Julimar Operations EP. This includes six exploration wells with wellheads. There are no other wellheads or property in the WA-49-L licence area. All other wells in the licence area have been permanently plugged and abandoned and wellheads removed.

3.8 Project Vessels

3.8.1 Project Vessel Overview

Several vessel types will be required to complete the Petroleum Activities Program. These are summarised in **Table 3-5**.

All project vessels will be 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 include 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.

For power generation, vessels may use diesel-powered generators and/or LNG. All vessels will display navigational lighting and external lighting on a 24-hour basis, 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*.

Table 3-5: Project Vessel Overview

Vessel	Activities
MODU	A semi-submersible moored MODU will be used to permanently plug the wells. While not likely, the MODU may be used to cut and recover the Xmas tree and wellhead. Typical specifications for a MODU are provided in **Table 3-6**.
Subsea Support Vessels (IMR vessel and/or AHV)	An IMR vessel or Anchor Handling Vessel (AHV) is to be used to conduct removal of marine growth prior to the permanent plugging activity and IMR activities. An AHV is to be used to install MODU moorings. An IMR vessel or AHV may be used to cut and recover infrastructure following plugging activities. Typical specifications for an IMR vessel and AHV are provided in **Table 3-7**.
General support vessels	General support vessels include cargo vessel(s) and barges. General support vessels are to be used for transporting equipment and materials from port/staging area to the Operational Area, and for general re-supply and support for the MODU. Support vessels will not anchor within the Operational Area due to water depth; therefore vessels will use Dynamic Positioning (DP). Support vessels are able to assist in implementing the Oil Pollution First Strike Plan (**Appendix I**). Support vessels may also have additional capability, such as ROV activities, deployment of subsea equipment, monitoring and inspection. Typical specifications for a general support vessel are provided in **Table 3-7**.

Table 3-6: Typical MODU specifications

Component	Specification Range
Rig type/design/class	Semi-submersible MODU (moored)
Accommodation (maximum persons on board)	~120 to 200 persons
Station keeping	Eight to twelve point anchor mooring system

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Component	Specification Range
Bulk mud and cement storage capacity	~283 to 770 m³
Liquid mud storage capacity	~576 to 2500 m³
Fuel oil storage capacity	~966 to 1400 m³

Table 3-7: Typical subsea support vessel specifications

Component	Specification Range	
	Sapura Constructor	***Far Saracen***
Type/Design/Class	IMR vessel	AHV
Accommodation (maximum persons on board)	~120 personnel	~40 personnel
Station keeping	DP2	DP2
Fuel (@ 90% capacity)	~1006 m³	~998 m³
Lube oil storage capacity	~35 m²	~20 m³

3.8.2 Vessel Mobilisation

Vessels may mobilise from the nearest Australian port or directly from international waters to the Operational Area, in accordance with relevant biosecurity and marine assurance requirements.

3.9 Other Support

3.9.1 Remotely Operated Vehicles

The MODU, subsea support vessels are typically equipped with an ROV system that is maintained and operated by a specialised contractor aboard the vessel. ROVs may be used for activities such as:

- visual inspections/observations
- anchor hold testing
- seabed and hazard survey
- placement of ROV tool baskets and mud mats on the seabed
- subsea rigging, handling and cutting
- corrosion survey
- marine growth cleaning of the wellhead and removal of the debris cap
- Xmas tree or wellhead connector preparation
- Xmas tree or wellhead disconnection
- Xmas tree control system installation and functioning
- manual valve functioning
- open water tool observation and guidance
- sediment relocation
- blowout preventer (BOP) land-out and recovery
- BOP well control contingency

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- BOP maintenance (including chemical injection)
- wellhead tooling and cutting
- post-activity seabed survey.

An ROV may also be used in an incident to deploy the Subsea First Response Toolkit. This is discussed further in **Appendix D.**

3.9.2 Helicopters

During the Petroleum Activities Program, crew changes will be performed using helicopters as required. Helicopter operations within the Operational Area are limited to helicopter take-off and landing on the helideck. Helicopters may be refuelled on the helideck.

3.10 Project Vessel Based Activities

3.10.1 Support Activities

A variety of materials are routinely bulk transferred from general support vessels to the MODU or subsea support vessel including equipment, well intervention fluids and cements. A range of bulk transfer stations and equipment is in place to accommodate the bulk transfer of each type of material. There is also a capacity to bulk transfer well intervention fluids and waste oil to the support vessel, for back loading and disposal on shore.

The loading and back-loading of equipment, materials and wastes will be one of the most common supporting activities conducted during the Petroleum Activities Program. Loading and back-loading is undertaken using cranes to lift materials in appropriate offshore rated containers (ISO tanks, skip bins, containers) or as bundles (tubulars) between the MODU and a support vessel.

Potable water, primarily for accommodation and associated domestic areas, will be generated on the main project vessels using a reverse osmosis plant. This process will produce brine, which is diluted and discharged at the sea surface.

The vessels will also discharge deck drainage from open drainage areas, bilge water from closed drainage areas, putrescible waste and treated sewage and grey water. Hazardous and non-hazardous waste generated are removed from the vessels and disposed of onshore.

3.10.2 Subsea Cleaning and Permanent Plugging Preparation Activities

A subsea support vessel will be mobilised prior to the MODU to undertake the following activities as required:

- cleaning to remove marine growth on Xmas trees
- removal and replacement of Horizontal Xmas tree debris cap
- reconnection / installation of Hydraulic Flying Leads (HFLs) for tree control
- installation of a Temporary Tree Control Skid
- tree function and pressure testing
- pre-lay MODU moorings may also be installed if an AHV is used.

3.10.3 Mooring Installation and Anchor Holding Testing

Due to the shallow water depth, the MODU is to be moored to the seabed to allow it to stay in position during the Petroleum Activities Program. The MODU mooring system includes chain/wire/fibre and anchors, and can be pre-laid before the MODU arrives in the Operational Area, or upon MODU arrival. A mooring analysis is undertaken to determine the appropriate mooring pattern for the eight

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to twelve point anchors, which are placed in a radius around the MODU. A single mooring pattern will be used and the MODU will kedge between wells.

Installation and proof tensioning of anchors involves some disturbance to the seabed. AHVs are used in the deployment and recovery of the mooring system. As part of mooring preparations, anchor holding testing may be conducted.

Anchor hold testing may consist of an AHV or similar vessel deploying an anchor at a potential mooring location. The AHV would then tension the anchor to determine its ability to hold, embed and not drag at the location. This may have to be repeated several times at each location. An ROV may also be used to judge how deep the anchor has embedded and independently verify the seabed condition. Anchor hold testing activities would occur before the MODU arrives on location.

Soil analysis may also be necessary to provide data about composition and rock/substrate strength, as input into the mooring or conductor design, and verify seabed conditions for anchor hold. Soil analysis could include taking a physical sample of the seabed using ROV or other tools, or using measuring devices such as a cone penetrometer.

On completion of the well P&A program, the mooring anchors may be pulled or released and the MODU will depart the Operational Area. Any released anchors will be retrieved by a subsea support vessel.

3.10.4 Refuelling/Bunkering

The MODU will be refuelled via support vessels about once a month, or as required. This activity will occur within the Operational Area[3] and has been included in the risk assessment for this EP. Other fuel transfers that may occur on board the MODU include refuelling of cranes, helicopters or other equipment as required. The general support vessels do not require refuelling offshore. Refuelling will only commence in daylight hours.

3.10.5 Dynamic Positioning

Vessels supporting the Petroleum Activities Program may use dynamic positioning (DP). DP uses satellite navigation and radio transponders in conjunction with thrusters to maintain position at the required location.

3.10.6 Marine Growth Removal

Excess marine growth may need to be removed using ROV before performing permanent plugging activities. **Table 3-8** lists the different growth removal techniques that may be used.

Table 3-8: Marine growth removal methods

Activity/Equipment	Description
Water jetting	Uses high-pressure water to remove marine growth
Brush systems	Uses brushes attached to an ROV to physically remove marine growth
Acid (typically sulphamic acid)	Chemically dissolves calcium deposits

3.10.7 Sediment Relocation

If sediment build up around subsea infrastructure has the potential to impede the Petroleum Activities Program, a water jet or ROV-mounted suction pump may be used to move the sediment in the immediate vicinity of the infrastructure (i.e. within the existing footprint), to allow work to be performed.

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[3] Note that the Operational Area is more than 12 nm from North and South Muiron Islands, Montebello Islands, Lowendal Islands, and Barrow Island.

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3.10.8 Subsea Inspection, Maintenance, and Repair Activities

Subsea well infrastructure has been designed and left in a state of preservation that will not require any significant degree of IMR activities. The IMR activities for subsea infrastructure, including once the well infrastructure becomes redundant following permanent plugging, maintains equipment in good condition and repair, for permanent plugging and to enable future removal.

The requirement for subsea well inspection and maintenance activities is managed under the NOPSEMA-accepted WOMP, which outlines the approach to inspection and maintenance activities to verify the ongoing integrity of the wells. An ongoing risk-based process is prescribed under the WOMP. This process involves assessing well integrity status, inspection data and threats, then using this data to re-evaluate risks and define inspection frequencies and determine if maintenance or repair is required.

Subsea activities are typically undertaken from a subsea support vessel and use ROV.

Maintenance and repair activities may require the deployment of frames/baskets which are temporarily placed on the seabed. These typically have a perforated base with a seabed footprint of about 15 m^2. This temporary equipment is removed from field via recovery to project vessels at the completion of IMR activities.

3.10.8.1 Inspections

Inspection of subsea well infrastructure is the process of physical verification and assessment of components in order to detect changes to the condition by comparison to initial state following installation and previous inspections.

The current in-force WOMP carries a 4-yearly inspection interval. The last inspection of the wells was performed in May 2020, during which no anomalies were identified.

3.10.8.2 Maintenance

Maintenance activities on subsea wells infrastructure may be required at regular or planned intervals to prevent deterioration or integrity failure of infrastructure; or due to specific requirements. Typical maintenance activities may include:

- cycling of valves
- marine growth removal
- leak and pressure testing

For Balnaves, no regular maintenance is planned prior to Permanent Abandonment activities.

3.10.8.3 Repair

Repair activities are those required when a subsea system or component is degraded, damaged or has deteriorated to a level outside of acceptance limits. Damage sustained may not necessarily pose an immediate threat to continued system integrity but may present an elevated level of risk to environment or production reliability. Due to the design of subsea infrastructure and materials used, repairs will be undertaken on an as needs basis. The requirements and frequency of these repairs will be dictated by the outcome of the inspection and maintenance regimes as managed under the WOMP.

3.11 MODU Based Permanent Plugging Activities

3.11.1 Permanent Plugging

The permanent plugging activities for the Balnaves wells, including designing and installing permanent well barriers, will be completed in accordance with the NOPSEMA-accepted Well

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Operational Management Plan (WOMP) as required under the OPGGS (Resource Management and Administration) Regulations 2011.

Reservoir and upper abandonments will be performed sequentially per well through a marine riser. Each well plugging sequence will depend on multiple aspects of each well, which include well design and integrity, casing cement quality and quantity, and scale levels (if present).

The planned permanent plugging scope for the Balnaves wells includes the following steps:

- position the MODU over well and anchor or connect to pre-laid anchors (**Section 3.10.3**)
- clean and prepare Xmas tree as required for landing the BOP (**Section 3.10.2**)
- run and land BOP on marine riser and interface with Xmas tree (**Section 3.11.1.1**)
- run Subsea Test Tree and Universal Running Tool and latch onto Internal Tree Cap or Tubing Hanger (**Section 3.11.1.1**)
- recover internal tree cap / upper crown plug(s) (**Section 3.11.1.1**)
- lubricate and bleed annulus to remove gas lift gas from production wells via the X-over system. This operation could potentially be conducted at a more opportune time later in sequence depending on further design assessments (**Section 3.11.1.5**)
- retrieve lower crown plug and drift tubing as required (**Section 3.11.1.1** and **3.11.1.7**)
- bullhead kill and / or circulate well fluids from well as required; vent and/or flare hydrocarbons as required during this operation (**Section 3.11.1.2**)
- a deep-set plug may be installed prior to subsequent operations or at a more opportune time later in the sequence (**Section 3.11.1.4**)
- recover upper completion to MODU (**Section 3.11.1.3**)
- some wells may require removal of (part of the) lower completion to facilitate permanent plugging (**Section 3.11.1.3**)
- assess casing and annulus cement integrity at abandonment interval as required; remediate poor or insufficient annulus cement as required (**Section 3.11.1.4**, **3.11.1.7**, and **3.12.2**)
- set and verify reservoir abandonment plugs (**Section 3.11.1.4**)
- punch and/or remove 9-5/8” casing and hanger as required, circulate casing annulus to seawater to remove Non-Water Based Mud (NWBM) above upper abandonment plug installation depth (**Section 3.11.1.5**)
- install cement plug to isolate remaining NWBM in the well from seabed (**Section 3.11.1.5**)
- recover BOP (**Section 3.11.1.6**)
- repeat for each well
- perform as left survey using ROV (**Section 3.13.3**)
- recover anchors and leave Operational Area (**Section 3.10.3**).

3.11.1.1 BOP and Subsea Control Systems

Permanent plugging of the Balnaves wells commences with the installation of a BOP run on a marine riser. The BOP and marine riser provide a physical connection between the well and MODU. This enables a closed circulation system to be maintained, where fluids can be circulated from the well bore back to the MODU, resulting in no unplanned discharges directly to sea. A subsea test tree and landing string is run inside the marine riser and BOP which connects to the internal tree cap or tubing hanger to facilitate primary well control during the well kill and abandonment.

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In addition, the subsea test tree inside the BOP provides a way to seal, control and monitor the well during permanent plugging activities. The operation of the BOP components uses open hydraulic systems, using water-based BOP control fluids. Each time the BOP is operated (including pressure testing about every 21 days and a function test about every seven days, excluding the week a pressure test is conducted), the maximum volume of BOP control fluid that will be released to the marine environment per test is up to 90 L. The functioning of subsea test tree valves and controls will discharge control fluid into the marine riser that will be contained and returned to the MODU tanks.

Standard operations through the landing string and subsea test tree also include running logging and/or evaluation tools and removal of crown plugs and drifting tubing. During these operations the control system for the Xmas tree operates in open loop, meaning control fluid is discharged to sea. Approximately 1-3 m^3 of Transaqua HT2 is expected to be discharged per well.

3.11.1.2 Well Kill

Following connection of the subsea test tree, well kill fluid will be pumped into the formation. This is to control the residual pressure from the formation and to bullhead well fluids into the reservoir. The well kill fluid will be a weighed brine. The type of brine will be assessed and will comply with the approved chemical assessment process outlined in **Section 3.15**.

Any fluids (gas and liquids) in the tubing-annulus may be bullheaded into the tubing and subsequently the reservoir, bled off or circulated to the MODU. Fluids returned to the MODU during well kill operations will pass through a fluid handling bleed off package. The bleed off package is designed to take fluids through a choke and into a liquid knock out vessel or a surge tank (pressure rated). The knock out vessel includes a separator which allows for gas and liquids to be separated. The gas, dependant on pressures and volumes, will be flared via the burner boom or cold vented from a safe location overboard. Liquids from the knock out vessel or surge tank can be pumped to the burner head and burned via air atomisation or be diverted to a water treatment package. Fluids able to be treated via the water filtration package to less than 30 ppm oil in water content will be discharged overboard. Where 30 ppm is not achievable, fluids will be toted into tanks for onshore disposal.

During well kill operations, the volumes returned to the MODU will depend on how much can be bullheaded into the formation successfully. The maximum volumes that could be returned to the MODU are up to about 1.55 MMscf of gas per well which may be flared/vented from the MODU, and up to about 155 m^3 of produced liquid per well may be returned for processing through the fluid handling and bleed off package.

3.11.1.3 Tubing Recovery

Following well kill operations, the tubing and/or packer are cut and retrieved. Any residual hydrocarbons that might still be present in the well after well kill operations have been completed and the tubing is pulled, could be circulated out. The residual hydrocarbons and Water Based Mud (WBM), brine or treated seawater returned to the MODU during this operation will be routed via the MODU's mud system. If returned fluids are to be discharged, it will be treated prior to discharge to less than 1% by volume oil content. If discharge specification cannot be met, the fluid will be returned to shore.

In addition, the lower completion may require removal on some wells to gain access to the permanent plugging interval. This will involve cutting the packer and tubing and retrieving to MODU.

3.11.1.4 Installation of Permanent Barriers

Cement is planned to be used for the permanent plugging of the Balnaves wells. Upon arrival at the Operational Area, the MODU is typically required to perform a cement unit test to test the functionality of the cement unit and the MODU bulk cement delivery system before performing an actual cement

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job. Proper functioning of the cement system is important for ensuring well integrity. This operation is usually performed after a MODU has been out of operation for a length of time (warm-stack or cold-stack), if maintenance on the cement unit has been performed, or if it is the first time a MODU is being used in-country and commissioning of the cement unit system is required.

A cement unit test involves mixing a cement slurry at surface, and once functionality of the cement unit and delivery system has been confirmed, the slurry is discharged through the usual cement unit discharge line (which may be up to 10 m above the sea surface) or through drill pipe below the sea surface. The slurry is usually a mix of cement and water; however, may contain stabilisers or chemical additives in low concentrations.

Cementing fluids will generally consist of Portland cement with additives (such as inorganic salts, lignins, bentonite, barite, silicates, defoamers and surfactants). Cementing fluids are not routinely discharged to the marine environment, however, volumes of about 5 m^3 per well will be released when surplus fluids require disposal after cementing operations at the surface.

Installation of the permanent barriers involves downhole casing and cement integrity being verified via wireline logging if required. If required to remediate poor or insufficient annulus cement, casing may be perforated and cement circulated behind the casing or the casing may be cut or milled (refer to **Section 3.12.2**). Following this, permanent abandonment cement plugs will be installed and verified.

3.11.1.5 B-Annulus Clean-out

After installation of the reservoir permanent abandonment plugs, the 9-5/8" casing will be punched and / or an upper section of the casing and its hanger will be removed and the NWBM removed from the annulus. The 13-3/8" casing may be punched if required for NWBM removal from the annulus. When displacing NWBM from the annulus, a series of fluid pills (high viscosity, surfactants) are pumped ahead of brine or WBM to improve displacement efficiency, minimise the contamination interface and minimise residual NWBM on the downhole casing. The recovered NWBM and interface fluids are captured in a mud pit and returned to shore. After removal of the NWBM from the annulus, an upper abandonment cement plug will be installed to contain any remaining NWBM if required.

Any NWBM and clean-out fluids from this operation will be routed via the MODU's mud system. Clean-up brine contaminated with base oil or NWBM, will be discharged if content is less than 1% by volume oil. If discharge specification cannot be met (i.e. is greater than 1% by volume oil content), the fluid will be returned to shore. Up to 160 m^3 of fluid containing greater than 1% oil from NWBM may be returned to the MODU per well and taken to shore for disposal.

During the upper abandonment operation, any NWBM which was removed from the annulus may be left inside the casing and contained below the upper abandonment cement plug.

3.11.1.6 Moving Between Wells

Once the well abandonment cement plugs have been set, tested and verified, the MODU riser and BOP will be disconnected from the well and returned to the MODU before kedging to the next well.

3.11.1.7 Wireline and Slickline Operations

Wireline or slickline activities that may occur for permanent plugging activities include gamma ray and casing collar locator logging for depth correlation, ultrasonic imaging and cement bond logging to measure cement integrity and running of other tools in hole such as SCSSV hold-open sleeves, drifts, plugs, punch perforators/cutters etc., plug removal and installation. Wireline and slickline work will be performed within the riser through the subsea test tree or BOP with appropriate isolation barriers in place. If wireline work is required to occur where there is a risk of barrier failure, the operation will be performed with full pressure control equipment at the surface.

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3.11.2 Cement, Barite and Bentonite Discharge

Excess cement, barite and bentonite (dry bulk) after well operations are completed, will either be held onboard and used for subsequent wells, provided to another operator at the end of the program, or discharged to the marine environment. Excess cement, barite and bentonite that does not meet technical requirements during the Petroleum Activities Program may also be bulk discharged to the environment. Bulk discharges of cement may occur as a slurry through the usual cement discharge line, or blown as dry bulk and discharged.

3.11.3 Mud Pits

There are typically mud pits (tanks) on the MODU that provide a capacity to mix, maintain and store fluids required for drilling and permanent well plugging activities. The mud pits form part of the fluid circulation system. The mud pits and associated equipment/infrastructure are cleaned out at the completion of operations. Mud pit wash residue is operationally discharged with less than 1% by volume of oil. Mud pit residue over 1% by volume of oil is sent to shore for disposal.

3.11.4 Well Tubulars

During well plugging and abandonment activities, production tubing will be recovered to surface and assessed for contamination (e.g. NORM and mercury). In the case that contamination is identified, the tubing will be managed as per Woodside procedures appropriate for the contamination type and level. If uncontaminated, this tubing may be transported onshore for disposal. All waste will be handled and disposed of in accordance with Federal, State and international requirements.

3.12 Additional Potential Activities for Permanent Plugging of Wells

The following activities may be required, if operational or technical issues occur during the Petroleum Activities Program. These additional activities have been considered within the relevant impact assessment sections and do not represent significant additional risks or impacts, but may generate additional small volumes of drilling fluids and drilled cement being operationally discharged, which have been assessed as part of the Petroleum Activities Program.

3.12.1 Marine Riser Clean Out

Woodside and industry experience has shown that horizontal Xmas tree systems can be susceptible to rust and other build up in the marine risers and BOP. This can lead to multiple deployments of subsea test trees or other large diameter pulling tools, as this type of debris, albeit small volumes, can prevent successful land out of tools.

To mitigate potential debris issues, the following activities may be performed as required:

1. Ensure riser is clean prior to initial deployment for the P&A of the first well.
2. Running of riser brushes while the riser and BOP are suspended (open water).
3. Implementing a BOP flushing sequence prior to landing the BOP on the HXT.
4. Once the BOP and riser are landed out, cleaning tools are available to clean the interface surfaces where debris build-up might take place.
5. In case of significant debris issues, the marine riser might be recovered to deck and inspected. Equipment will be available on the MODU to enable cleaning of the riser joints before being redeployed. Cleaning will be done over a bunded area, with fluids returned to tanks on the MODU.
6. Should debris continue to be a problem after brushing and circulation to the mud pits, then the riser might be disconnected from the Xmas tree and an ROV will be used to flush the remaining debris from around the top of the Xmas tree cap.

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3.12.2 Milling

If the cement on the outside of the casing does not meet well barrier requirements, casing or tubing liners may need to be removed either by cutting and pulling or milling. These operations are done through the marine riser with milling debris returned to the MODU and will only be performed if needed.

Milling operations involve removing steel casing, annulus cement and formation to expose fresh formation. The methods used include milling tools that create chips or ribbons of steel (swarf), chips of cement and chips of formation. Milling is typically performed at a controlled rate (1 to 1.5 m/hr), to enable steel swarf to be removed effectively from the milling site to minimise the risk of 'birds nesting' of steel swarf, which may block fluid returns and jam equipment. Milling tools become worn during milling operations and will require tripping for new/redressing about every 30 to 50 m. As a result, the rate of milling is slower than normal drilling operations.

As the steel swarf within the milled fluids is hard and sharp, these fluids from the well will not be processed through drilling muds process equipment such as cuttings driers and centrifuges, because they will damage or excessively wear the equipment. The milling fluids, including up to an additional 2 m^3 of swarf, 3 m^3 of drilled cement and 3.5 m^3 of formation rock, will be discharged overboard per 100 m interval if milling is required. As a result of restricted milling speeds, the rate of swarf and cement will be generated over several days (the rate is expected to be about 50 m per 18 hours).

3.12.3 Drilling Out a Cement Plug

During the permanent plugging operation, if the permanent cement plugs do not pass the verification test, then drilling out of this cement plug will be required so the cement plug can be reinstalled. WBM will be used, and the WBM and cement cuttings will be processed through the drilling muds process equipment on board the MODU and discharged overboard. This will generate about 25 m^3 of cement cuttings per plug and use approximately 250 m^3 of WBM.

3.12.4 Xmas Tree Removal

Following the plugging activities, the Balnaves Xmas trees may be disconnected from the wellhead and removed from the top of the well to allow the wellhead to be cut by the MODU below the seabed. In this instance, it is planned to remove the Xmas tree(s) for placement on a mud mat next to the wellhead. Xmas tree and wellhead recovery would then be undertaken with a subsea support vessel (see **Section 3.13**).

Mud mats are used to provide stability to wet parked structures due to the nature of the seafloor sediments. The carbon steel mud mat will likely be deployed by the MODU and is approximately 3.5 m x 3.5 m in size. The mud mat, if deployed to support an Xmas tree being placed on the seabed, will be recovered with the Xmas tree.

3.13 Removal and Recovery of Infrastructure

3.13.1 Well Infrastructure

Well infrastructure is planned to be removed and recovered as part of the Petroleum Activities Program, in accordance with EPBC 2011/6188 condition 4(a) (see **Table 1-4**). However, structures may temporarily remain in field post permanent plugging for between 3 months and 2.5 years prior to recovery. The preferred method is using a subsea support vessel to remove and recover the Xmas trees and utilise an abrasive water jet (AWJ) to cut the wellhead casings below the seabed and recover the wellhead as part of a broader campaign (see **Section 3.12.4**). Options for removing the wellheads are described in **Table 3-9** and recovering both the wellheads and Xmas trees are described in **Table 3-10.**

In the event permanent guide base(s) (PGBs) are found to be below the mudline and attempted recovery is unsuccessful, they will be permanently left in-situ.

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Table 3-9: Wellhead cutting methods

Method	Description	MODU/ vessel type	Preference
Abrasive water jet cutting	**Method:** Method uses a system of high pressure water entrained with grit and flocculant pumped via an umbilical from a vessel to a subsea cutting tool that is inserted into the inner well casing **Uses:** Suitable where an internal cut can be achieved and within water depths shallower than approximately 300-350 m, due to requirement for high pressure jetting. Not restricted by number of casing strings.	Subsea support vessel (IMR or AHV)	Preferred method. Planned cut at 3-5 m below the mudline in accordance with international Well standard practice, e.g. Oil and Gas UK Well Decommissioning Guidelines (OGUK 2018). Provides a high certainty of success given this allows for additional cut attempts by moving up.
External cutting using diamond wire saw	**Method:** Method uses a hydraulically driven motor and pulley system to operate an industrial diamond cutting wire via a vessel or ROV. Clamps to the outside of wellhead at the base and cuts externally. **Uses:** Suitable for wells within all water depths. Cut at or below mudline.	Subsea support vessel (IMR or AHV)	Contingency option if preferred option is unsuccessful.
Mechanical internal cutting	**Method:** Method uses mechanical cutting knives that are inserted into the inner well casing and rotated **Uses:** Suitable for wells with up to two casing strings, where an internal cut can be achieved, and within all water depths.	MODU or subsea support vessel (IMR or AHV)	Contingency option only

Table 3-10: Well infrastructure removal and recovery timing

Infrastructure	Removal	Recovery	Preference
Xmas trees	Removal by a MODU or subsea support vessel (IMR or AHV following plugging activities.	Recovery to the MODU immediately following plugging activities.	Method and timing for removal and recovery of well infrastructure will be dependent on technical considerations, vessel availability, opportunities for efficiencies with other decommissioning campaigns, suitable weather windows and health, safety and environmental considerations. Utilising a subsea support vessel or MODU for cutting and recovery of well infrastructure will achieve the same outcome of removal. Although infrastructure may be left in-situ for up to 2.5 years following plugging, this is considered to be acceptable given: • it will not affect success of future removal (e.g. cathodic protections systems will be in place, if required) • recent survey of well infrastructure in May 2020, detected no corrosion • there are no new or increased impacts / risks to the environment from infrastructure remaining in-situ for this period (**Section 6**). This flexibility in the method and timing for removal and recovery of infrastructure
		Recovery by a subsea support vessel (IMR or AHV) immediately following plugging activities	
		Recovery by a subsea support vessel (IMR or AHV) before the end of 2024[1]	
Wellheads	Removal by a MODU during plugging activities.	Recovery by a MODU immediately following plugging activities.	
		Recovery by a subsea support vessel (IMR or AHV) immediately following plugging activities	
		Recovery by a subsea support vessel (IMR or	

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Infrastructure	Removal	Recovery	Preference
		AHV) before the end of 2024	provides cost efficiencies as well as reduced impacts and risks to the environment (e.g. reduced time and emissions/discharges across projects).
	Removal and recovery by a subsea support vessel (IMR or AHV) immediately or up to two years following plugging activities[1]		

[1] Xmas trees placed on the seabed may require a mud mat due to the seabed stability. Engineering work to confirm the requirement is yet to be completed, but Xmas trees will be wet parked in a manner to facilitate recovery. Mud mat(s) will be recovered when the Xmas trees are recovered (**Table 3-3**).

3.13.2 DTM Anchors

The DTM anchors are 9 m wide and 8.5 m long and are at most buried to 5 m - 5.5 m below the mudline at the tip. The padeye with a short length of anchor chain is likely to be between just below mudline and 2 m below mudline. Removal of the DTM anchors, under the OPGGS Act Section 572(3), was evaluated and compared against leaving them buried in the seabed, below the mudline. An evaluation of all residual environmental impacts and risks from the two options, following application of control measures to manage and minimise the impacts and risks, is provide in **Table 3-11**.

Table 3-11: Evaluation of the feasibility and environmental impacts and risk of DTM anchor decommissioning options

	Removal	Leave burried
Description of options		
Method	Use a subsea support vessel to deploy a sub-bottom profiler over the area where the anchors are located to confirm their location. Once located, use an ROV to water jet sediment away from the anchor location in an attempt to find the short length anchor mooring chain left attached to the anchor. In addition it may be necessary to dredge to approximately 5-5.5 m deep where the anchors are estimated to be located. Connect the support vessel wire to the chain and pull to dislodge the anchor from the seabed. Retrieve to surface. Repeat for each of the six anchors.	Leave the anchors buried in the seabed.
Feasability		
Technical risk	Assuming the anchors can be located (noting that sub-bottom profilers have a detection limit of 10 m below the seabed) then technically it is feasible Recovery requires the bollard pull of a vessel large enough to overcome the friction of the anchor burial. To facilitate retrieval, additional dredging of sediment may be required to uncover the anchor prior to pulling.	Technically feasible.
Environmental impacts and risks		
Physical presence: seabed disturbance	Disturbance to seabed from suction dredging or water jetting sediment away from the anchors would be designed and controlled in such as way as to limit seabed disturbance to that required to uncover and dislodge each anchor. Elimination of seabed disturbance is not possible, as the anchors are confirmed as buried. Seabed disturbance for retrieving six anchors is estimated to result in the dredging /	Reminants of the anchors may remain within a localised area below the seabed where the anchors are buried. Six DTM anchors made of steel comprises predominantly of iron (~98%). As they corrode they will turn into iron oxide ($Fe(0H)_2$ and $Fe(OH)_3$). Iron hydroxide is an inert form of iron, and has a very low toxicity. There are currently no trigger values for iron or its forms of hydroxide in the marine

	water jetting of 780 m^2 of sediment (approximately 130 m^2 per anchor). This is expected to result in a slight, short term effect to soft sediment habitats, an E consequence. Removal of the DTM anchors would eliminate reminants from the anchors occurring below the seabed (from the anchors rusting over time).	environment and as such is considered no threat to the receiving marine environment (ANZG, 2018). Due to the low toxicity to biota and the slow release rate, impacts to sediment quality are expected to be localised, with no lasting effect, an F consequence. Leaving the DTM anchors buried would eliminate seabed disturbance associated with removal.
Physical presence: interaction with other marine users	This activity would most likely be done with the same vessel contracted to undertake MODU anchor removal activities. Additional duration in field is estimated to be 12-18 days (two to three days per anchor, depending on duration to locate the anchor and dredge to find the chain). As such, no significant differences have been identified for these environmental impacts and risks.	No significant differences in these environmental impacts and risks as a vessel is still required to undertake the remaining Petroleum Activities program.
Routine acoustic emissions		
Routine and non-routine discharges		
Routine and non-routine atmospheric emissions Routine light emissions		
Unplanned hydrocarbon release: vessel collision		
Unplanned physical disturbance to seabed (dropped object)		

Leaving the six DTM anchors buried below the seabed is a better environmental outcome when compared to removal, due to the seabed disturbance required to unbury the anchors to enable retrieval. Even with controls in place to reduce disturbance, such as minimising dredging to that required to uncover the anchors, an estimated 780 m^2 of seabed would need to be disturbed. The amount of dredging required to enable full recovery will result in a worse environmental impact when compared to leaving them buried. Leaving the anchors in situ does not result in physical seabed disturbance associated with removal and there is no threat to the receiving marine environment from their degradation overtime.

No long term monitoring and management of the anchors is proposed, as the anchors have been confirmed as completely buried during the previous decommissioning removal activities, and there is no lasting effect to the marine environment from degradation and no impact ot other marine users.

All other environmental impacts and risks have no significant differences between the two options as a vessel is still required to undertake the remaining Petroleum Activities program. Therefore impacts and risks associated with vessel activities will still occur, and are not able to be eliminated by leaving the anchors buried.

Consistent with Section 572(7) and Section 270(3)(c)(ii), Woodside proposes to leave the DTM anchors in situ based on the outcomes from the environmental impacts and risks assessment, as it provides a better environmental outcome when compared to removal of the DTM anchors.

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The environmental impacts and risks of leaving the anchors buried are evaluated in more detail Section 6 and demonstrates impacts and risks associated with the leaving the DTM anchors in situ is ALARP and acceptable.

3.13.3 Seabed Survey

Make good any damage to the seabed or subsoil, is a requirement under Section 270(3)(f) of the OPGGS Act. Seabed surveys undertaken following the completion of the previous decommissioning activities for the Balnaves field in 2016 indicate that there are shallow depressions of approximately ~0.4 m in depth below the surrounding seabed as a result of MODU anchoring and indentations from removed infrastructure. Damage to the seabed from the proposed permanent plugging activities are assessed in **Section 6**. This seabed disturbance is predicted to gradually infill over time, acting as depositional areas for suspended material in the area. As such no seabed remediation is planned for the Petroleum Activities Program.

An ROV seabed clearance survey will be conducted following final infrastructure removal activities to confirm all infrastructure on the seabed has been removed. Infrastructure embedded subsurface, below the seabed will not be removed. This consists of the six mooring anchors as identified in **Section 3.6**.

3.13.4 Sediment Sampling

Sediment sampling is planned to be undertaken as part of the Petroleum Activities Program. Sediment sampling will be undertaken from a Subsea Support Vessel using either an ROV or drop corer to collect a sample of the seabed sediments.

3.14 Unplanned Contingency Activities

3.14.1 Emergency Disconnect Sequence

An Emergency Disconnect Sequence (EDS) may be implemented if the intervention vessel/MODU is required to rapidly disengage from the well. The EDS closes the BOP (i.e. shutting in the well) and disconnects the riser to break the conduit between the BOP and MODU. Common examples of when this system may be initiated include when the MODU moves outside of its operating circle (e.g. failure of one or more of the moorings) or moves to avoid a vessel collision (e.g. third-party vessel on collision course with the MODU). The EDS aims to leave the well in a secure condition but will result in the loss of the fluids in the riser after disconnection.

3.14.2 Temporary Well Suspension

During permanent plugging activities, a well may need to be temporarily suspended (e.g. in the case of adverse weather or unexpected well outcomes requiring additional time to plan the next operation). Suspension involves establishing suitable barriers, removing the riser and disconnecting the MODU from the well. The BOP may be left in place to act as a barrier or removed if sufficient barriers are present in the well itself. On return to a well after suspension, the MODU reconnects to the well via the riser and well plugging activities resume.

3.15 Project Fluids

3.15.1 Assessment of Project Fluids

All chemicals that may be operationally released or discharged to the marine environment by the Petroleum Activities Program are evaluated, using a defined framework and set of tools, to ensure the potential impacts are acceptable, ALARP and meet Woodside's expectation for environmental performance. This excludes legacy chemicals, including residual NWBM currently present in the wellbore, which have been assessed for discharge in **Section 6.6.5**.

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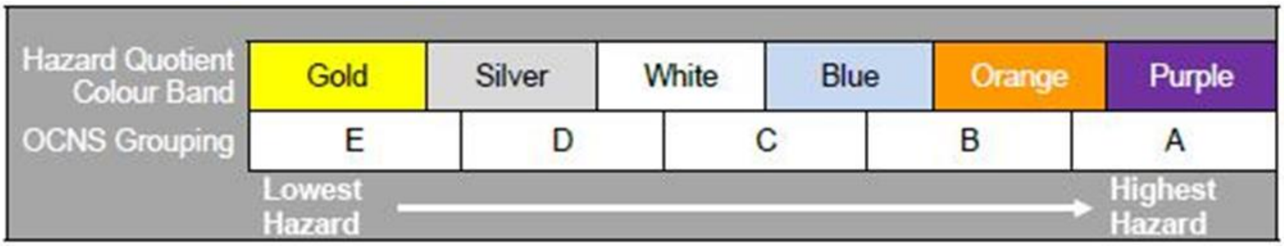
All approved plugging and drilling chemicals are included on the Woodside Drilling and Completions Chemical Assessment Register which is reviewed as per the Chemical Selection and Assessment Environment Guideline.

The chemical assessment process follows the principles outlined in the Offshore Chemical Notification Scheme (OCNS), which manages chemical use and discharge in the United Kingdom and the Netherlands. It applies the requirements of the Convention for the Protection of the Marine Environment of the North-East Atlantic (Oslo and Paris Commission for the Convention for the Protection of the Marine Environment of the North-East Atlantic [OSPAR] Convention). The OSPAR Convention is widely accepted as best practice for managing chemicals.

All chemical substances listed on the OCNS ranked list of registered products have an assigned ranking based on toxicity and other relevant parameters, such as biodegradation and bioaccumulation, in accordance with one of two schemes (as shown in **Figure 3-3**):

- Hazard Quotient (HQ) Colour Band: Gold, Silver, White, Blue, Orange and Purple (listed in order of increasing environmental hazard), or
- OCNS Grouping: E, D, C, B or A (listed in order of increasing environmental hazard). Used for inorganic substances, hydraulic fluids and pipeline chemicals only.



Hazard Quotient Colour Band	Gold	Silver	White	Blue	Orange	Purple
OCNS Grouping	E	D	C	B	A	

Figure 3-3: OCNS ranking scheme

Chemicals fall into the following assessment types:

- No further assessment: Chemicals with an HQ band of Gold or Silver, or an OCNS ranking of E or D with no substitution or product warnings, do not require further assessment. Such chemicals do not represent a significant impact on the environment under standard use scenarios and are therefore considered ALARP and acceptable.
- Further assessment/ALARP justification required: The types of chemicals that need to be assessed further to understand the environmental impacts of discharge into the marine environment are:
  - chemicals with no OCNS ranking
  - chemicals with an HQ band of white, blue, orange, purple or an OCNS ranking of A, B or C
  - chemicals with an OCNS product or substitution warning.

3.15.1.1 Further Assessment/ALARP Justification

This includes assessing the ecotoxicity, biodegradation and bioaccumulation of the chemicals in the marine environment in accordance with the United Kingdom Centre for Environment, Fisheries and Aquaculture Science (CEFAS) hazard assessment and the Department of Mines and Petroleum (DMP) (now Department of Mines, Industry Regulation and Safety) Chemical Assessment Guide: Environmental Risk Assessment of Chemicals used in WA Petroleum Activities Guideline.

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3.15.1.2 Ecotoxicity

Chemical ecotoxicity is assessed using the criteria used by CEFAS to group chemicals based on ecotoxicity results (**Table 3-12**). If a chemical has an aquatic or sediment toxicity within the criteria for the OCNS grouping of D or E, this is considered acceptable in terms of ecotoxicity.

Table 3-12: CEFAS OCNS grouping based on ecotoxicity results

Initial grouping	A	B	C	D	E
Results for aquatic-toxicity data (ppm)	<1	>1-10	>10-100	>100-1,000	>1,000
Result for sediment toxicity data (ppm)	<10	>10-100	>100-1,000	>1,000-10,000	>10,000

Note: Aquatic toxicity refers to the Skeletonema constatum EC50, Acartia tonsa LC50 and Scophthalmus maximus (juvenile turbot) LC50 toxicity tests; sediment toxicity refers to Corophium volutator LC50 test.

Biodegradation

The biodegradation of chemicals is assessed using the CEFAS biodegradation criteria, which align with the categorisation outlined in the DMP Chemical Assessment Guide: Environmental Risk Assessment of Chemicals used in WA Petroleum Activities Guideline.

CEFAS categorises biodegradation into the following groups:

- Readily biodegradable: results of more than 60% biodegradation in 28 days to an OSPAR harmonised offshore chemical notification format (HOCNF) accepted ready biodegradation protocol.
- Inherently biodegradable: results more than 20% and less than 60% to an OSPAR HOCNF accepted ready biodegradation protocol or result of more than 20% by OSPAR accepted inherent biodegradation study.
- Not biodegradable: results from OSPAR HOCNF accepted biodegradation protocol or inherent biodegradation protocol are less than 20%, or half life values derived from aquatic simulation test indicate persistence.
- Chemicals with more than 60% biodegradation in 28 days to an OSPAR HOCNF accepted ready biodegradation protocol are considered acceptable in terms of biodegradation.

Bioaccumulation

The bioaccumulation of chemicals is assessed using the CEFAS bioaccumulation criteria, which align with the categorisation outlined in the DMP Chemical Assessment Guide: Environmental Risk Assessment of Chemicals used in WA Petroleum Activities Guideline.

The following guidance is used by CEFAS:

- Non-bioaccumulative: LogPow <3, or BCF ≤100 and molecular weight is ≥700.
- Bioaccumulative: LogPow ≥3 or BC >100 and molecular weight is <700.
- Chemicals that meet the non-bioaccumulative criteria are considered acceptable.

If a product has no specific ecotoxicity, biodegradation or bioaccumulation data available, options to be considered are as follows:

- Environmental data for analogous products can be referred to where chemical ingredients and composition are largely identical.
- Environmental data may be referenced for each separate chemical ingredient (if known) within the product.

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Alternatives

If no environmental data is available for a chemical or if the environmental data does not meet the acceptability criteria outlined above, potential alternatives for the chemical will be investigated, with preference for options with an HQ band of Gold or Silver, or OCNS Group E or D with no substitution or product warnings.

If no more environmentally suitable alternatives are available, further risk reduction measures (e.g. controls related to use and discharge) will be considered for the specific context and implemented where relevant to ensure the risk is ALARP and acceptable.

Decision

Once the further assessment/ALARP justification has been completed, concurrence is required from the relevant environment adviser that the environmental risk as a result of chemical use is ALARP and acceptable.

3.15.2 Drilling Fluid System

The base case of the proposed Petroleum Activities Program includes using WBM, well kill brine, drilling fluids and wet cement and will produce tubing, tubing annulus and casing annulus fluids (containing residual brine, WBM or NWBM, residual hydrocarbons and residual produced formation water). These fluids will be returned during well kill activities, well bore clean out, installation of permanent abandonment barriers, circulation of the casing-annulus and washing out of the mud pit. All chemicals selected for use will be assessed under Woodside's internal guidelines to ensure potential impacts are acceptable, ALARP and meet Woodside's expectation for environmental performance.

3.15.2.1 Water-based Mud System

The WBM will either be mixed on the MODU or received pre-mixed, then stored and maintained in a series of pits aboard the MODU. WBM drilling fluids that cannot be reused (e.g. due to bacterial deterioration or do not meet required drilling fluid properties) or are mixed in excess of required volumes, may be operationally discharged to the ocean under the MODU's Permit to Work (PTW) system. Opportunities to reuse the WBM drilling fluids at the end of the Petroleum Activities Program are reviewed across current Woodside drilling activities.

Potential additional activities that may be required as part of the Petroleum Activities Program include milling, which will produce metal swarf, drilled cement and formation rock (**Section 3.12.2**). While these additional activities are planned to use WBM, they may require using NWBM.

All of the downhole plugging for permanent abandonment activities are conducted through the marine riser. This is a closed system, meaning there are no planned discharges directly to sea during these activities. Planned discharges of the above fluids are only planned to occur after they have been received on the MODU and treated where required.

3.16 New Technologies

Permanent abandonment plug(s) are typically cement pumped into the well bore at specified interval(s) determined through the well barrier design process. There may also be new material technologies that fulfil permanent well plugging for abandonment requirements that may be considered instead of or in combination with cement. These will be assessed using the management of change assessment described in **Section 7.6** and, if required, the chemical selection and assessment process outlined in **Section 3.15**.

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4. DESCRIPTION OF THE EXISTING ENVIRONMENT

4.1 Overview

In accordance with Regulations 13(2) and 13(3) of the Environment Regulations, this section describes the existing environment that may be affected by the activity (planned and unplanned, as described in **Section 3**), including details of the particular relevant values and sensitivities of the environment, which were used for the risk assessment.

The EMBA is the largest spatial extent where unplanned events could have an environmental consequence on the surrounding environment. For this EP, the EMBA is the potential spatial extent of surface and in-water hydrocarbons at concentrations above ecological impact thresholds, in the event of the worst-case credible spill. The ecological impact thresholds used to delineate the EMBA are defined in **Table 4-1** and **Section 6.7.1**. The worst-case credible spill scenario for this EP is loss of well integrity.

Woodside recognises that hydrocarbons may be visible beyond the EMBA at lower concentrations than the ecological impact thresholds defined in **Table 4-1** and **Section 6.7.1**. These visible hydrocarbons are not expected to cause ecological impacts. In respect of this, an additional socio-cultural EMBA is defined, as the potential spatial extent within which social-cultural impacts may occur from changes to the visual amenity of the marine environment. Receptors relevant to the socio-cultural EMBA include Commonwealth and State marine protected areas (MPAs), National and Commonwealth Heritage Listed places, areas of tourism and recreation, and commercial and traditional fisheries. For this EP, the socio-cultural EMBA for surface hydrocarbons encompasses an area fully within the boundaries of the EMBA for ecological impacts. Shoreline accumulation of hydrocarbons may be visible at several locations along the WA coast from the North West Cape to Lacepede Islands, but below concentrations at which ecological impacts are expected to occur. The EMBA and socio-economic EMBA are shown in **Figure 4-1**.

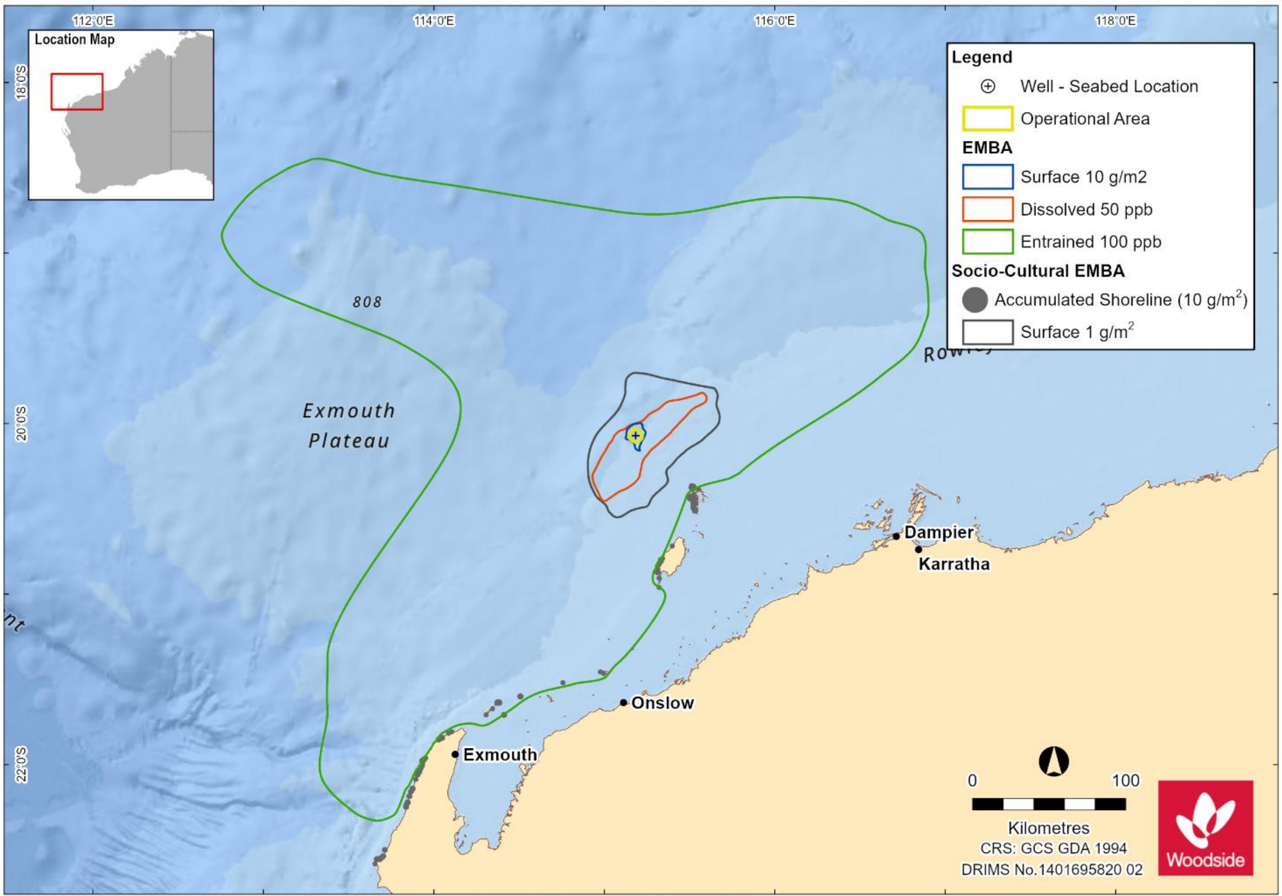
The EMBA presented does not represent the predicted coverage of any one hydrocarbon spill or a depiction of a slick or plume at any particular point in time. Rather, the areas are a composite of a large number of theoretical paths, integrated over the full duration of the simulations under various metocean conditions.

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

Hydrocarbon Type	EMBA[1]	Socio-cultural EMBA[1]	Planning Area for Scientific Monitoring
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 and, therefore, the concentration at which socio-cultural impacts to the visual amenity of the marine environment may occur. However, it is below concentrations at which ecological impacts are expected to occur. This low exposure value also establishes the planning area for scientific monitoring (NOPSEMA guidance note: A652993, April 2019).	
Dissolved	50 ppb This represents potential toxic effects, particularly sublethal effects to highly sensitive species (NOPSEMA guidance note: A652993, April 2019). As dissolved hydrocarbons are within the water column and not visible, impacts to socio-cultural receptors are associated with ecological impacts. Therefore, dissolved hydrocarbons at this threshold also represent the level at which socio-cultural impacts may occur.		10 ppb This low exposure value establishes the planning area for scientific monitoring (based on potential for exceedance of water quality triggers) (NOPSEMA guidance note: A652993, April 2019). This area is described further in **Appendix D: Figure 5-1**. In the event of a spill, DNP will be notified of AMPs which may be
Entrained	100 ppb		

Hydrocarbon Type	EMBA[1]	Socio-cultural EMBA[1]	Planning Area for Scientific Monitoring
	This represents potential toxic effects, particularly sublethal effects to highly sensitive species (NOPSEMA guidance note: A652993, April 2019). As entrained hydrocarbons are within the water column and not visible, impacts to socio-cultural receptors are associated with ecological impacts. Therefore, entrained hydrocarbons at this threshold also represent the level at which socio-cultural impacts may occur.		contacted by hydrocarbons at this threshold.
Shoreline	100 g/m^2 This represents the threshold that could impact the survival and reproductive capacity of benthic epifaunal invertebrates living in intertidal habitat.	10 g/m^2 This represents the volume where hydrocarbons may be visible on the shoreline but is below concentrations at which ecological impacts are expected to occur.	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***



Sources: Esri, HERE, Garmin, GEBCO, National Geographic, NOAA, and the GIS User Community, Esri, Garmin, GEBCO, NOAA NGDC, and other contributors

Figure 4-1: Environment that may be affected by the Petroleum Activities Program

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4.2 Regional Context

The Operational Area is located in Commonwealth waters within the North-west Marine Region (NWMR), as defined under the Integrated Marine and Coastal Regionalisation of Australia (IMCRA v4.0) (Commonwealth of Australia, 2006), in water depths of about 110 m to 160 m. Within the NWMR, the Operational Area lies within the NWS Province (**Figure 4-2**). Woodside's Existing Environment (**Appendix H: Section 2.1**) summarised the characteristics for the relevant marine bio-regions.

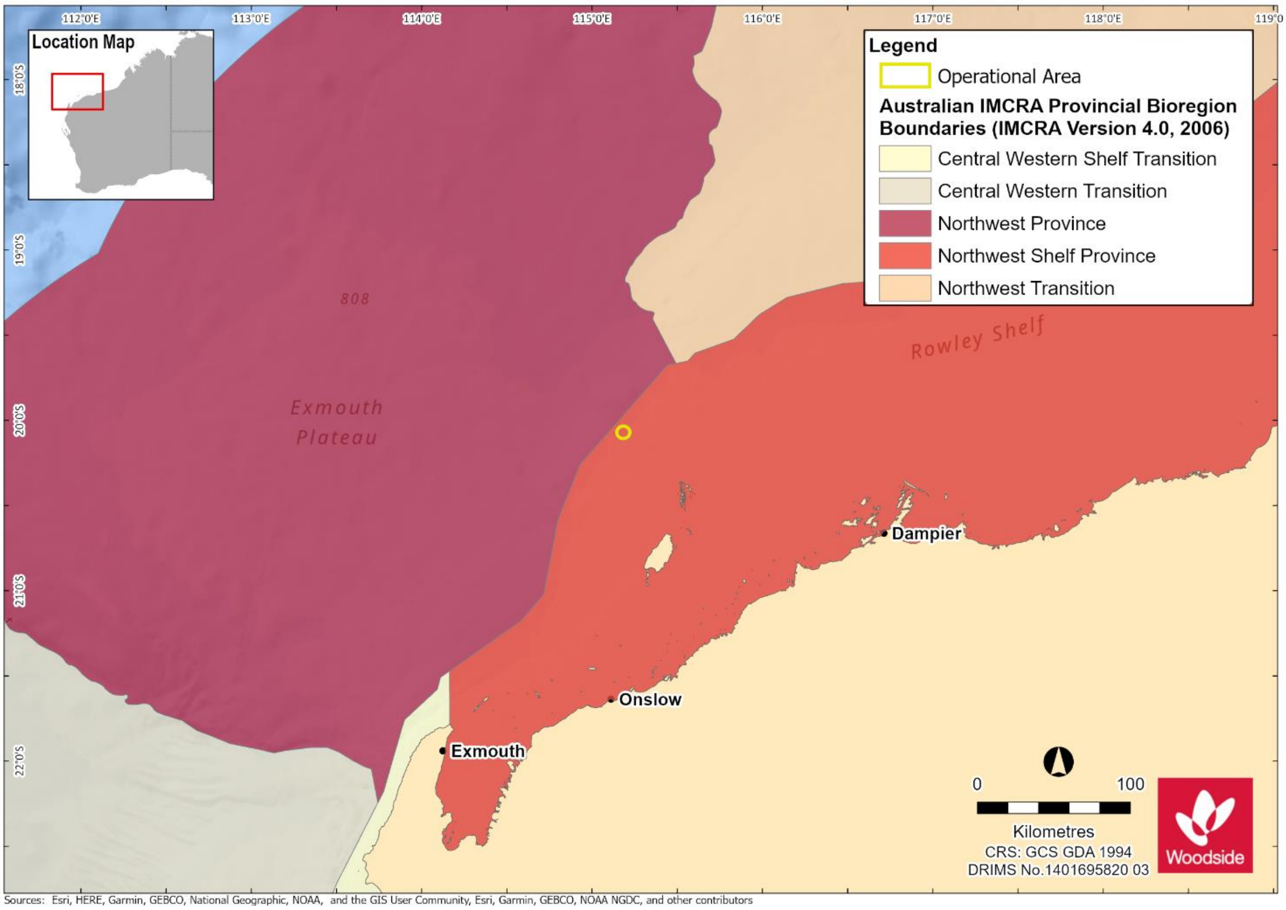

Figure 4-2: Location of the Operational Areas and relevant marine bio-regions

4.3 Matters of National Environmental Significance (EPBC Act)

Table 4-2 and **Table 4-3** summarise the Matters of National Environmental Significance (MNES) overlapping the Operational Area and EMBA, respectively, according to Protected Matters Search Tool (PMST) results (**Appendix C**). It should be noted that the EPBC Act PMST is a general database that conservatively identifies areas in which protected species, or their habitat, have the potential to occur.

Additional information on these MNES are provided in subsequent sections of this chapter and described in detail in **Appendix H**.

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Table 4-2: Summary of MNES identified by the EPBC Act Protected Matters Search Tool (PMST) as potentially occurring within the Operational Area

MNES	Number	Description
World Heritage Properties	None	The closest World Heritage Property is the Ningaloo Coast World Heritage Property, located 183 km south-west of the Operational Area.
National Heritage Places	None	The closest National Heritage Place is the Barrow Island and the Montebello-Barrow Islands Marine Conservation Reserves, located 35 km south-east of the Operational Area.
Wetlands of International Importance (Ramsar)	None	The closest Ramsar Wetland is Eighty Mile Beach, located 615 km ENE of the Operational Area.
Commonwealth Marine Area	1	Generally, the Commonwealth Marine Area stretches from three nautical miles to two hundred nautical miles from the coast.
Listed Threatened Ecological Communities	None	No Threatened Ecological Communities (TECs) as listed under the EPBC Act are known to occur within the marine waters of the NWMR (**Appendix H: Section 10.6**).
Listed Threatened Species	19	Threatened species that were identified by the PMST as potentially occurring within the Operational Area are identified in **Section 4.5.2.1** to **Section 4.5.2.4** and described in **Appendix H: Section 5 – Section 8.**
Listed Migratory Species	34	Migratory species that were identified by the PMST as potentially occurring within the Operational Area are identified in **Section 4.5.2.1** to **Section 4.5.2.4** and described in **Appendix H: Section 5 – Section 8.**

Table 4-3: Summary of MNES identified by the EPBC Act Protected Matters Search Tool (PMST) as potentially occurring within the EMBA

MNES	Number	Description
World Heritage Properties	1	The Ningaloo Coast World Heritage Property is located within the EMBA.
National Heritage Places	1	The Ningaloo Coast National Heritage Place is located within the EMBA.
Wetlands of International Importance (Ramsar)	None	There are no Ramsar Wetlands located within the EMBA.
Commonwealth Marine Area	1	The EMBA overlaps the NWMR.
Listed Threatened Ecological Communities	None	No Threatened Ecological Communities (TECs) as listed under the EPBC Act are known to occur within the marine waters of the NWMR (**Appendix H: Section 10.6**).
Listed Threatened Species	29	Threatened species that were identified by the PMST as potentially occurring within the EMBA are identified in **Section 4.5.2.1** to **Section 4.5.2.4** and described in **Appendix H: Section 5 – Section 8.**
Listed Migratory Species	53	Migratory species that were identified by the PMST as potentially occurring within the EMBA are identified in **Section 4.5.2.1** to **Section 4.5.2.4** and described in **Appendix H: Section 5 – Section 8.**

4.4 Physical Environment

The Operational Area is located on the upper continental slope in waters approximately 110 to 160 m deep (**Figure 4-3**). The seabed exhibits a gradual slope in a north-west direction at a gradient of

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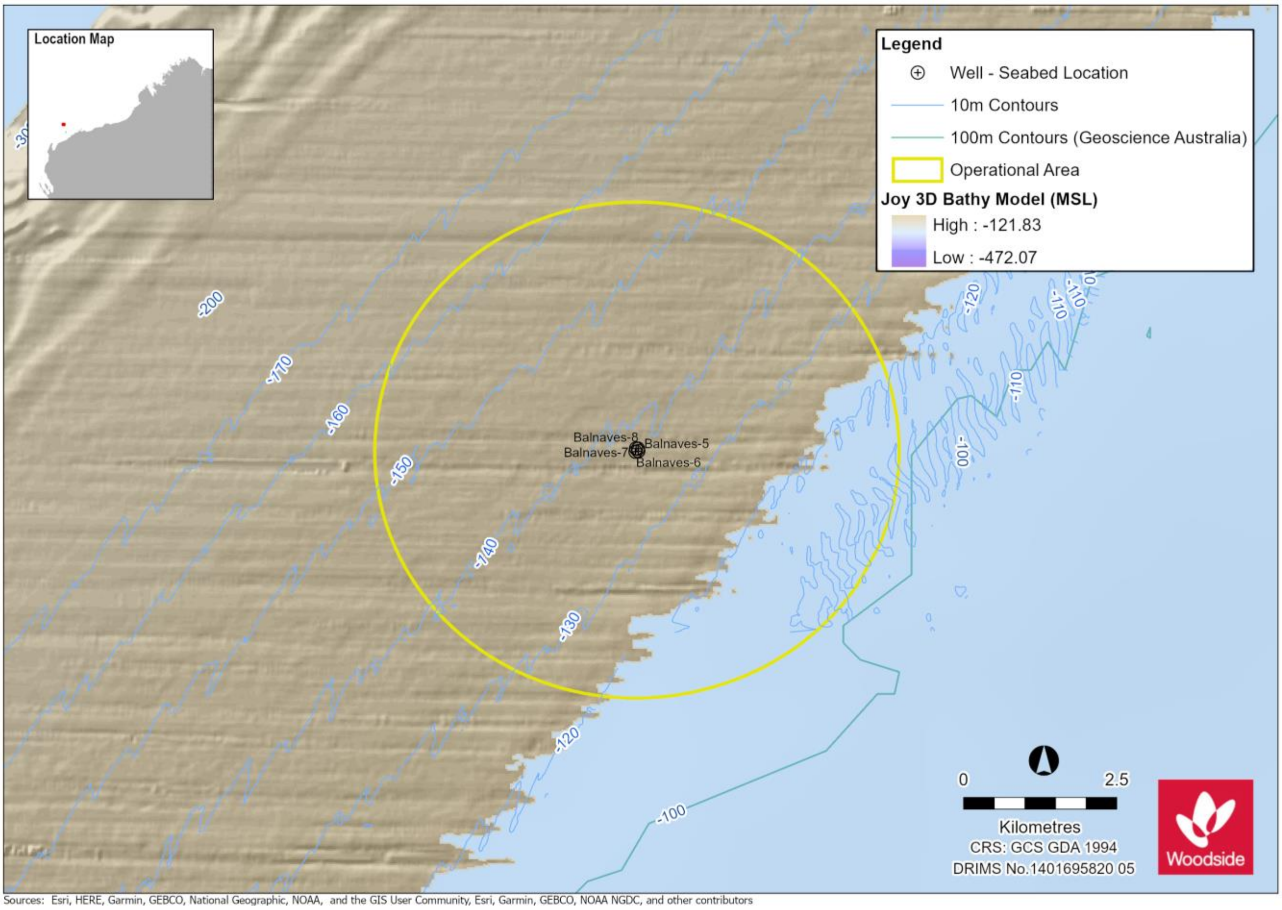
approximately -1% on average. Benthic surveys conducted in the area report the seabed consists of fine silt and mud sediments (RPS, 2011).

Appendix H: Section 2.3.3 provides a summary of the physical characteristics of the environment within the Operational Area. The Operational Area is influenced by ocean currents as described in **Appendix H: Section 2.3**, which also provides a summary of the physical characteristics of the environment within the wider EMBA.



Sources: Esri, HERE, Garmin, GEBCO, National Geographic, NOAA, and the GIS User Community, Esri, Garmin, GEBCO, NOAA NGDC, and other contributors

Figure 4-3: Bathymetry of the Operational Area and surrounding waters

4.5 Biological Environment

4.5.1 Habitats and Biological Communities

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 within the Operational Area during earlier phases the Balnaves Development recorded sparse (less than 5% cover) epibenthic fauna comprising occasional anemones, urchins, sea whips, sea pens, feather stars and glass sponges (RPS, 2011). 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, 2011). Similarly, at the Pluto Platform (about 14 km from the Operational Area), sampling revealed a sparsely abundant, variable and

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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). Additionally, it is expected that these infauna communities will be widely represented within the EMBA.

Key habitats and ecological communities within the EMBA are identified in **Table 4-4** and described in **Appendix H: Section 4.5**.

Table 4-4: Habitats and Communities within the EMBA

Habitat/community	Key locations within the EMBA
Marine primary producers	
Coral	• Montebello, Lowendal and Barrow Island Groups (40 km south-east of the Operational Area) • Muiron Islands Marine Management Area (183 km south-west of the Operational Area) • Ningaloo Reef (209 km south-west of the Operational Area) • Rankin Bank (151 km north-east of the Operational Area) Refer to **Appendix H: Section 4** for a description of coral communities in the NWMR.
Seagrass beds and macroalgae	• Montebello, Lowendal and Barrow Island Groups (40 km south-west of the Operational Area) • Seagrass beds and macroalgal habitats within the EMBA include those within Ningaloo Reef (183 km south-east of the Operational Area)
Mangroves	Shoreline accumulation of hydrocarbons is not expected above ecological thresholds and therefore no mangrove systems occur within the EMBA.
Sandy beaches	Shoreline accumulation of hydrocarbons is not expected above ecological thresholds and therefore no sandy beaches occur within the EMBA.
Salt marshes	Shoreline accumulation of hydrocarbons is not expected above ecological thresholds and therefore no salt marshes occur within the EMBA.
Other communities and habitats	
Plankton	Plankton within the Operational Area is expected to reflect the conditions of the NWMR. Primary productivity of the NWMR appears to be largely driven by offshore influences, with periodic upwelling events and cyclonic influences driving coastal productivity with nutrient recycling and advection. Refer to **Appendix H: Section 4.3** for a description of planktonic communities in the NWMR.
Pelagic and demersal fish populations	In the EMBA, fish diversity and abundance is typically correlated with habitat distribution, with complex habitats, such as coral and rocky reefs, hosting more diverse and abundant assemblages. Notable habitats hosting diverse fish assemblages include Ningaloo Reef (Stevens et al., 2009), Barrow Island and the Montebello Islands (de Lestang and Jankowski, 2015). Refer to **Appendix H: Section 5.5** for a description of pelagic and demersal fish populations in the NWMR.
Epifauna and infauna	The EMBA contains deep and shallow water habitats dominated by soft sediments and sparse benthic biota. The benthic communities inhabiting the predominantly soft, fine sediments of the deepwater benthic habitats are characterised by infauna such as polychaetes and sparsely distributed sessile and mobile epifauna. Refer to **Appendix H: Section 5.5** for a description of epifauna and infauna in the NWMR.

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4.5.2 Protected Species

A total of 55 EPBC Act listed species considered to be MNES were identified as potentially occurring within the EMBA, of which a subset of 36 species were identified as potentially occurring within the Operational Area. The full list of marine species identified from the PMST reports is provided in **Appendix C**, including several MNES that are not considered to be credibly impacted (e.g. terrestrial species within the EMBA). Criteria for determining species to be considered for impact assessment is outlined in **Appendix H: Section 3.2**. Two dependent species have also been identified with a potential to occur within the Operational Area and EMBA. These species, the southern bluefin tuna and scalloped hammerhead, are listed on the Species Profile and Threats Database (DAWE, 2021).

Table 4-5 to **Table 4-13** list the species identified as potentially occurring within the Operational Area and EMBA that have the potential to be impacted by the Petroleum Activities program, as well as overlapping Biologically Important Areas (BIAs) or Habitat Critical to their Survival (Habitat Critical). A description of each species is included in **Appendix H: Section 5 – Sectin 8**. **Figure 4-4** to **Figure 4-8** show the spatial overlap with relevant BIAs and Habitat Critical areas and the Operational Area and EMBA.

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4.5.2.1 Fish, Sharks and Rays

Table 4-5: Threatened and Migratory fish, shark and ray species predicted to occur within the Operational Area and EMBA

Species name	Common name	Threatened status	Migratory status	Potential for interaction	
				Operational Area	**EMBA**
Carcharias taurus (west coast population)	Grey Nurse Shark	Vulnerable	Migratory	Species or species habitat may occur within area	Species or species habitat known to occur within area
Carcharodon carcharias	White Shark	Vulnerable	Migratory	Species or species habitat may occur within area	Species or species habitat known to occur within area
Pristis clavata	Dwarf Sawfish	Vulnerable	Migratory	Species or species habitat known to occur within area	Species or species habitat known to occur within area
Pristis zijsron	Green Sawfish	Vulnerable	Migratory	Species or species habitat known to occur within area	Species or species habitat known to occur within area
Rhincodon typus	Whale Shark	Vulnerable	Migratory	Foraging, feeding or related behaviour known to occur within area	Foraging, feeding or related behaviour known to occur within area
Anoxypristis cuspidata	Narrow Sawfish	N/A	Migratory	Species or species habitat may occur within area	Species or species habitat known to occur within area
Carcharhinus longimanus	Oceanic Whitetip Shark	N/A	Migratory	Species or species habitat likely to occur within area	Species or species habitat likely to occur within area
Isurus oxyrinchus	Shortfin Mako	N/A	Migratory	Species or species habitat likely to occur within area	Species or species habitat likely to occur within area
Isurus paucus	Longfin Mako	N/A	Migratory	Species or species habitat likely to occur within area	Species or species habitat likely to occur within area

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Species name	Common name	Threatened status	Migratory status	Potential for interaction	
				Operational Area	EMBA
Manta alfredi	Reef Manta Ray	N/A	Migratory	Species or species habitat likely to occur within area	Species or species habitat known to occur within area
Manta birostris	Giant Manta Ray	N/A	Migratory	Species or species habitat likely to occur within area	Species or species habitat known to occur within area

Table 4-6: Fish, shark and ray BIAs within the Operational Area and EMBA

Species	BIA type	Approximate Distance of BIA from Operational Area (km)
Whale shark	Foraging (northward from Ningaloo along 200 m isobath)	Overlaps
	Foraging (high density prey) (Ningaloo Marine Park)	223 km south-west

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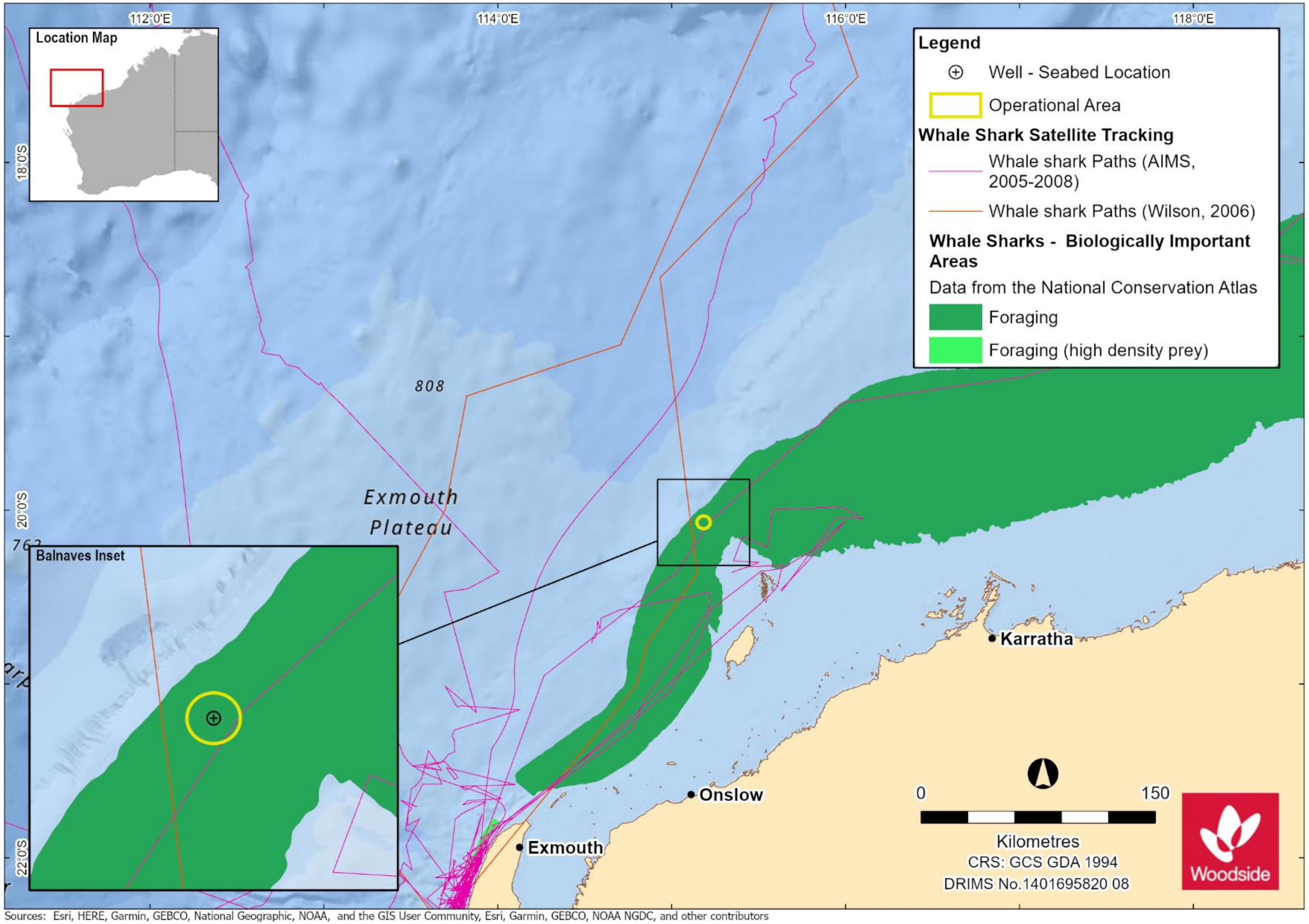

Figure 4-4: Whale shark BIAs and satellite tracks of whale sharks tagged between 2005 and 2008 (Meekan and Radford, 2010)

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4.5.2.2 Marine Reptiles

Table 4-7: Threatened and Migratory marine reptile species predicted to occur within the Operational Area and EMBA

Species name	Common name	Threatened status	Migratory status	Potential for interaction	
				Operational Area	**EMBA**
Caretta caretta	Loggerhead Turtle	Endangered	Migratory	Species or species habitat known to occur within area	Foraging, feeding or related behaviour known to occur within area
Chelonia mydas	Green Turtle	Vulnerable	Migratory	Species or species habitat known to occur within area	Breeding known to occur within area
Dermochelys coriacea	Leatherback Turtle	Endangered	Migratory	Species or species habitat likely to occur within area	Species or species habitat known to occur within area
Eretmochelys imbricata	Hawksbill Turtle	Vulnerable	Migratory	Species or species habitat known to occur within area	Breeding known to occur within area
Natator depressus	Flatback Turtle	Vulnerable	Migratory	Congregation or aggregation known to occur within area	Breeding known to occur within area
Aipysurus apraefrontalis	Short-nosed Sea snake	Critically Endangered	N/A	N/A	Species or species habitat known to occur within area

Table 4-8: Marine turtle BIAs within the Operational Area and EMBA

Species	BIA type	Approximate Distance of BIA from Operational Area (km)
Flatback turtle	Internesting (Barrow Island, Montebello Islands)	Overlaps
	Internesting (Dampier Archipelago)	69 km east
	Internesting (Thevenard Island, Pilbara southern coastline)	52 km south
	Nesting (Barrow Island, Montebello Islands)	50 km south-east

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Species	BIA type	Approximate Distance of BIA from Operational Area (km)
	Mating (Montebello Islands)	50 km south-east
	Foraging (Montebello Islands)	50 km south-east
Green turtle	Internesting (Barrow Island, Montebello Islands)	18 km south-east
	Nesting (Barrow Island, Montebello Islands)	50 km south-east
	Mating (Montebello Islands)	50 km south-east
	Foraging (Montebello Islands)	50 km south-east
	Internesting (North West Cape, Muiron Islands, Montebello Islands)	165 km south-west
Hawksbill turtle	Internesting (Barrow Island, Montebello Islands)	23 km south-east
	Nesting (Barrow Island, Montebello Islands)	50 km south-east
	Mating (Montebello Islands)	50 km south-east
	Foraging (Montebello Islands)	50 km south-east
	Internesting (North West Cape)	190 km south-west
Loggerhead turtle	Internesting (Thevenard Island, Montebello Islands)	23 km south-east
	Nesting (Thevenard Island, Barrow Island, Montebello Islands)	50 km south-east
	Mating (Montebello Islands)	50 km south-east
	Foraging (Montebello Islands)	50 km south-east
	Internesting (North West Cape)	190 km south-west

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Table 4-9: Internesting Habitat Critical to the Survival of Marine Turtle Species predicted to occur within the Operational Area and EMBA

Species	Genetic Stock	Nesting Locations	Approximate Distance of Area from Operational Area	Inter-nesting buffer	Nesting period	Hatching period
Flatback turtle	Pilbara	Montebello Islands, Mundabullangana Beach, Barrow Island, Cemetery Beach, Dampier Archipelago (including Delambre Island and Huay Island), coastal islands from Cape Preston to Locker Island	Overlaps	60 km	Oct–Mar (peak: Feb-Mar)	Oct–Mar
Green turtle	North West Shelf	Barrow Island, Montebello Islands (all with sandy beaches), Serrurier Island, Thevenard Island, Northwest Cape, Ningaloo coast	23 km south	20 km	Nov–Mar	Jan–May (peak: Feb–Mar)
Hawksbill turtle	Western Australia	Montebello Islands (including Ah Chong Island, South East Island and Trimouille Island), Lowendal Islands (including Varanus Island, Beacon Island and Bridled Island), Sholl Island	23 km south	20 km	All year (peak: Oct–Feb)	All year (peak: Dec–Feb)
Loggerhead turtle	Western Australia	Muiron Islands, Gnaraloo Bay, Ningaloo coast	167 km south-west	20 km	Nov–May (peak: Jan)	Jan–May
Leatherback turtle	No overlap – nesting located in Northern Territory and North Queensland					
Olive ridley turtle	No overlap – nesting located in Northern Australia and North Queensland					

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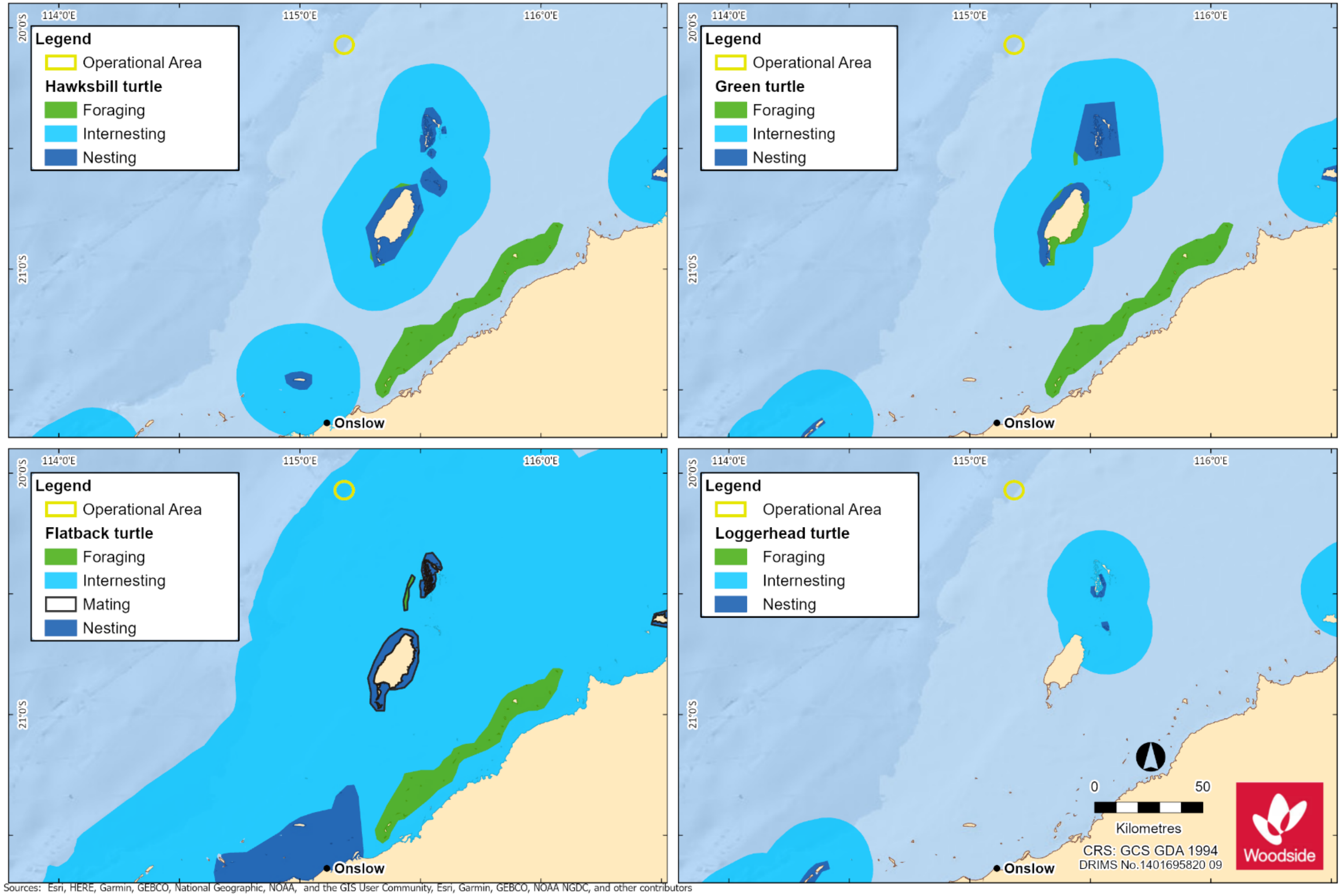
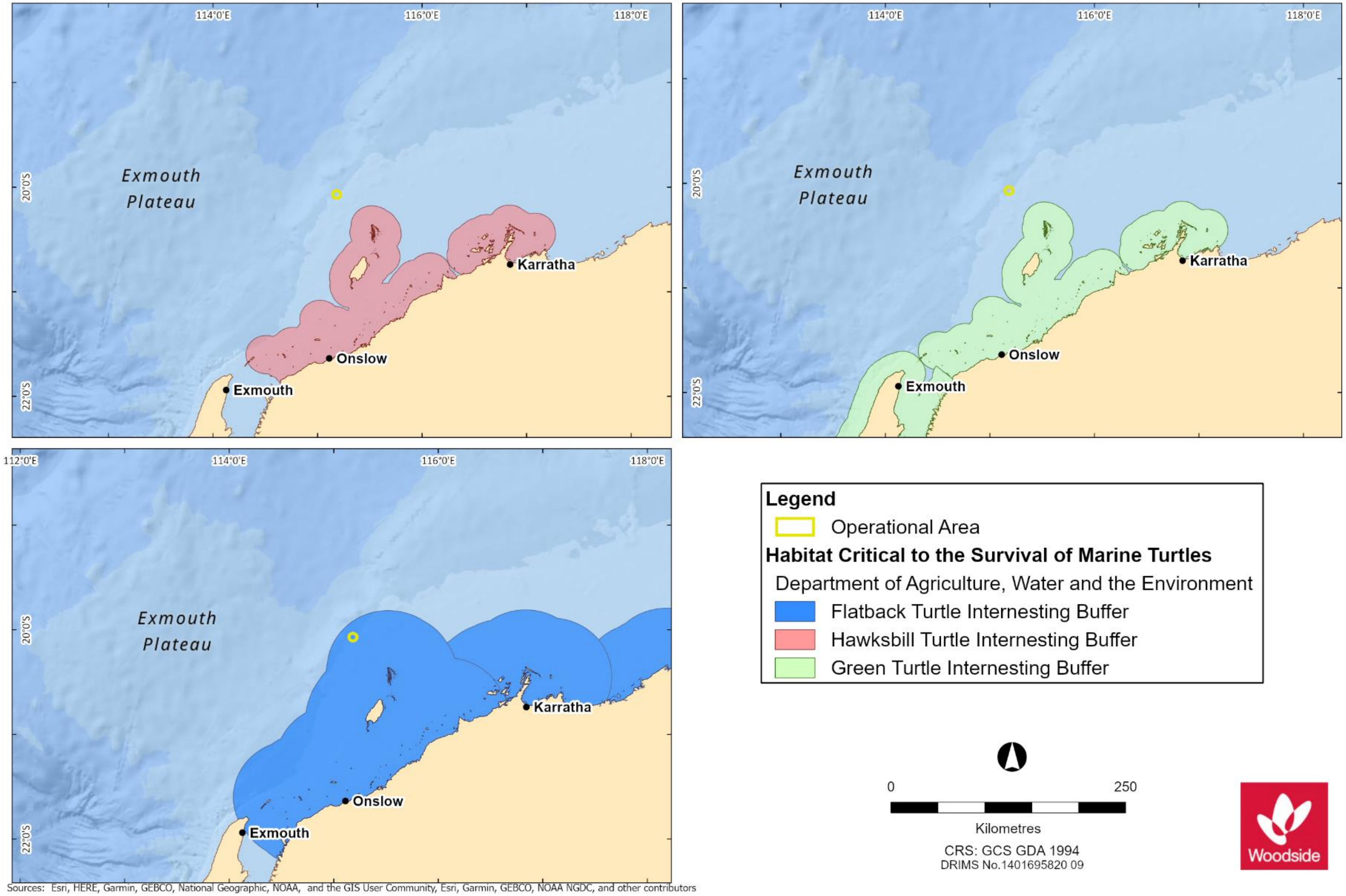


Sources: Esri, HERE, Garmin, GEBCO, National Geographic, NOAA, and the GIS User Community, Esri, Garmin, GEBCO, NOAA NGDC, and other contributors

Figure 4-5: Marine turtle BIAs



Sources: Esri, HERE, Garmin, GEBCO, National Geographic, NOAA, and the GIS User Community, Esri, Garmin, GEBCO, NOAA NGDC, and other contributors

Figure 4-6: Habitat Critical to the Survival of Marine Turtles

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4.5.2.3 Marine Mammals

Table 4-10: Threatened and Migratory marine mammal species predicted to occur within the Operational Area and EMBA

Species name	Common name	Threatened status	Migratory status	Potential for interaction	
				Operational Area	**EMBA**
Balaenoptera musculus	Blue Whale	Endangered	Migratory	Species or species habitat likely to occur within area	Migration route known to occur within area
Megaptera novaeangliae	Humpback Whale	Vulnerable	Migratory	Species or species habitat known to occur within area	Breeding known to occur within area
Balaenoptera borealis	Sei Whale	Vulnerable	Migratory	Species or species habitat likely to occur within area	Foraging, feeding or related behaviour likely to occur within area
Balaenoptera physalus	Fin Whale	Vulnerable	Migratory	Species or species habitat likely to occur within area	Foraging, feeding or related behaviour likely to occur within area
Balaenoptera edeni	Bryde’s Whale	N/A	Migratory	Species or species habitat likely to occur within area	Species or species habitat likely to occur within area
Orcinus orca	Killer Whale	N/A	Migratory	Species or species habitat may occur within area	Species or species habitat may occur within area
Physeter macrocephalus	Sperm Whale	N/A	Migratory	Species or species habitat may occur within area	Species or species habitat may occur within area
Tursiops aduncus (Arafura/Timor Sea populations)	Spotted Bottlenose Dolphin	N/A	Migratory	Species or species habitat may occur within area	Species or species habitat known to occur within area
Eubalaena australis	Southern Right Whale	Endangered	Migratory	N/A	Species or species habitat likely to occur within area

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Species name	**Common name**	**Threatened status**	**Migratory status**	**Potential for interaction**	
				Operational Area	**EMBA**
Balaenoptera bonaerensis	Antarctic Minke Whale	N/A	Migratory	N/A	Species or species habitat likely to occur
Dugong dugon	Dugong	N/A	Migratory	N/A	Breeding known to occur within area
Sousa chinensis	Indo-Pacific Humpback Dolphin	N/A	Migratory	N/A	Species or species habitat known to occur within area

Table 4-11: Marine mammal BIAs within the Operational Area and EMBA

Species	**BIA type**	**Approximate Distance of BIA from Operational Area (km)**
Humpback whale	Migration (north and south - extends from the coast to out to approximately 100km off shore in the Kimberley region extending south to North West Cape. From north-west Cape to south of Shark Bay the migration corridor is reduced to approximately 50 km.)	21 km south
Pygmy blue whale	Migration (Augusta to Derby, tend to pass along the shelf edge at depths of 500 m to 1,000 m; appear close to coast in the Exmouth-Montebello Islands area on southern migration)	3 km north
	Foraging (Ningaloo Reef)	228 km south-west
Dugong	Foraging, breeding, nursing and calving (Ningaloo and Exmouth Gulf)	205 km south-west

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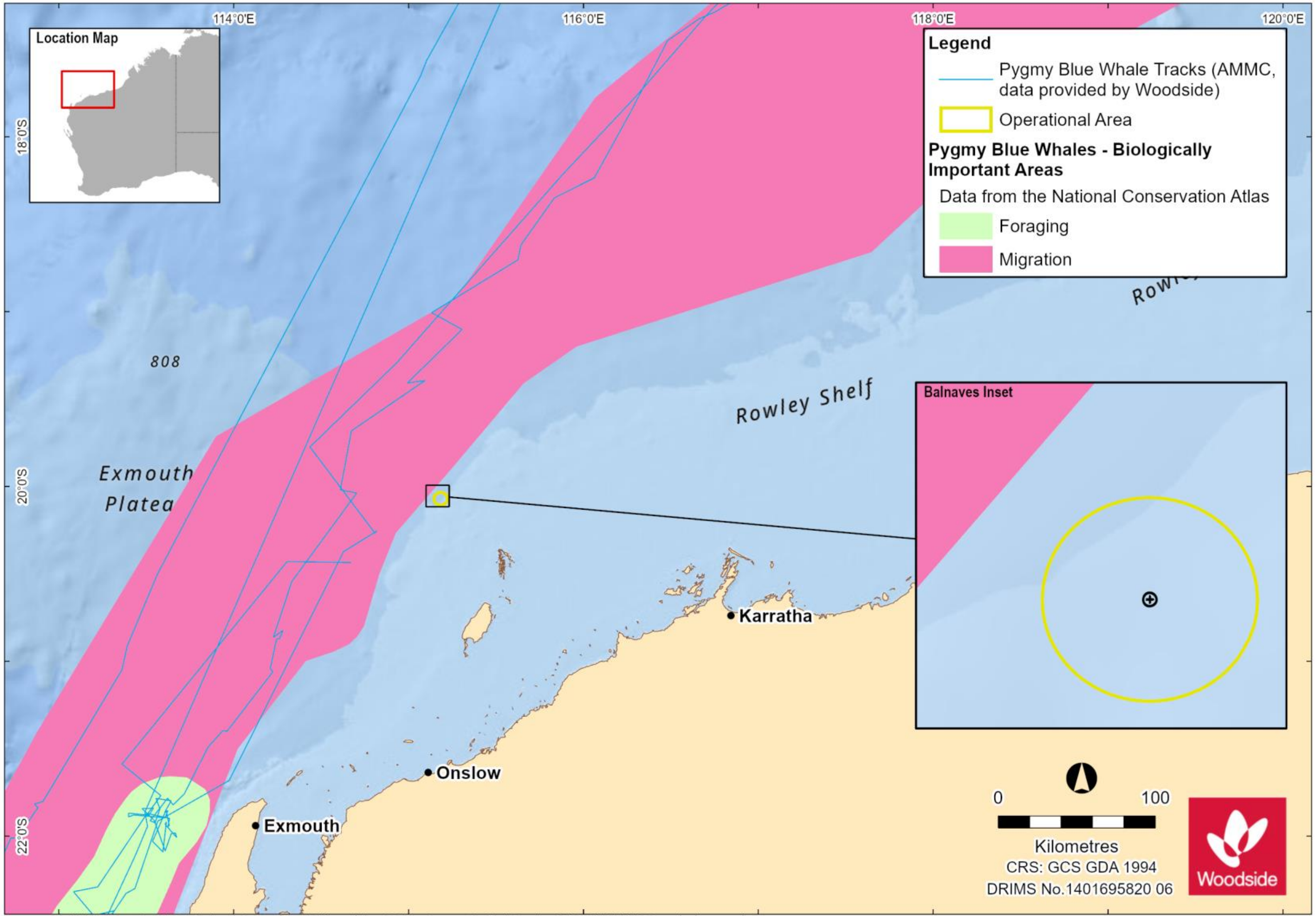

Sources: Esri, HERE, Garmin, GEBCO, National Geographic, NOAA, and the GIS User Community, Esri, Garmin, GEBCO, NOAA NGDC, and other contributors

Figure 4-7: Pygmy blue whale BIAs and satellite tracks of tagged whales (Double et al., 2012, 2014)

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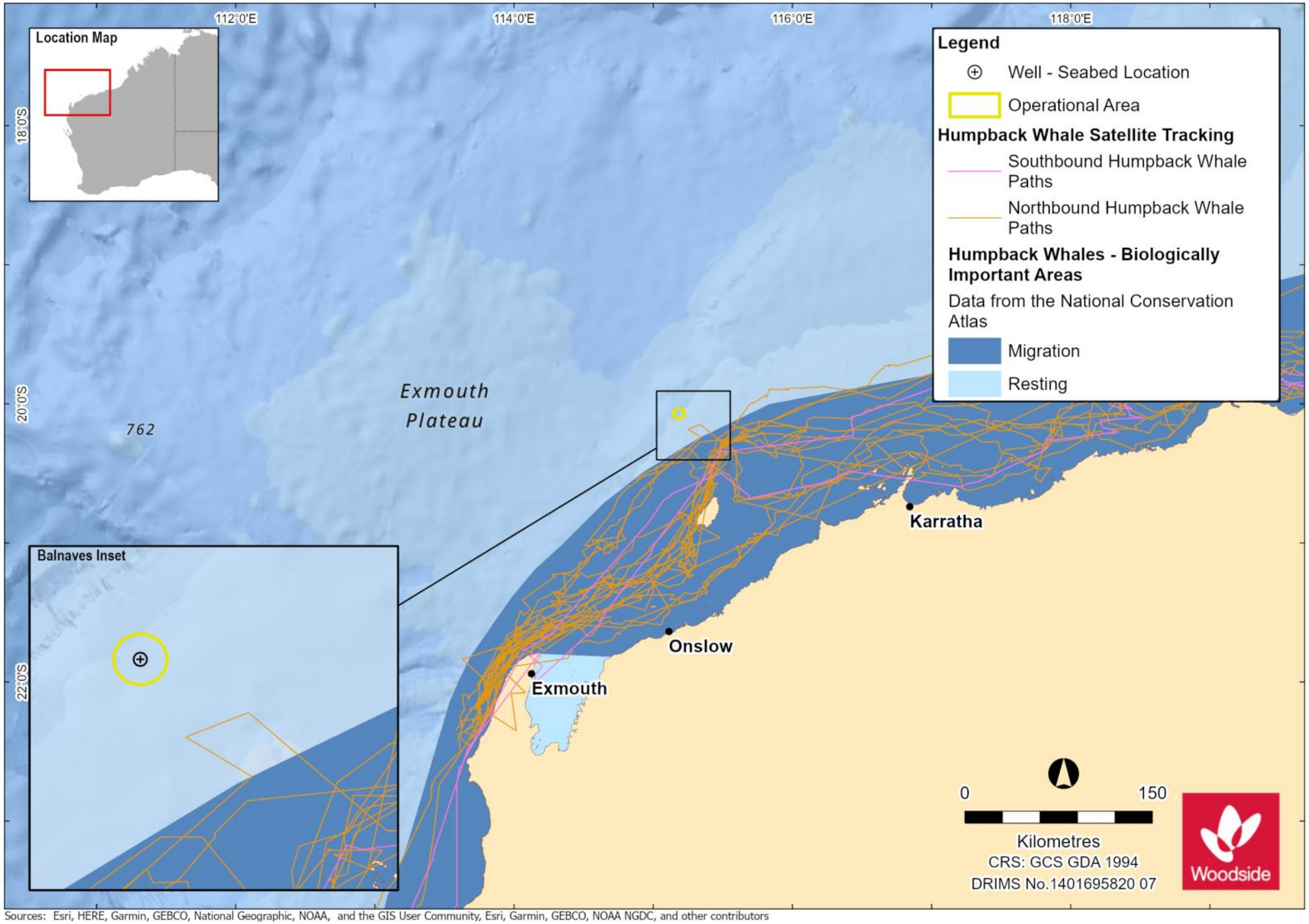

Figure 4-8: Humpback whale BIAs and satellite tracks of whales tagged between 2010 and 2012 (Double et al., 2012, 2010)

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4.5.2.4 Seabirds and Migratory Shorebirds

Table 4-12: Threatened and Migratory seabird and migratory shorebird species predicted to occur within the Operational Area and EMBA

Species name	Common name	Threatened status	Migratory status	Potential for interaction	
				Operational Area	EMBA
Calidris canutus	Red Knot	Endangered	Migratory	Species or species habitat may occur within area	Species or species habitat known to occur within area
Calidris ferruginea	Curlew Sandpiper	Critically Endangered	Migratory	Species or species habitat may occur within area	Species or species habitat known to occur within area
Macronectes giganteus	Southern Giant-Petrel	Critically Endangered	Migratory	Species or species habitat may occur within area	Species or species habitat may occur within area
Numenius madagascariensis	Eastern Curlew	Critically Endangered	Migratory	Species or species habitat may occur within area	Species or species habitat known to occur within area
Sternula nereis	Australian Fairy Tern	Vulnerable	N/A	Species or species habitat may occur within area	Breeding known to occur within area
Anous stolidus	Common Noddy	N/A	Migratory	Species or species habitat may occur within area	Species or species habitat likely to occur within area
Calonectris leucomelas	Streaked Shearwater	N/A	Migratory	Species or species habitat likely to occur within area	Species or species habitat likely to occur within area
Fregata ariel	Lesser Frigatebird	N/A	Migratory	Species or species habitat may occur within area	Species or species habitat likely to occur within area
Limosa lapponica menzbieri	Northern Siberian Bar-tailed Godwit	Critically Endangered	N/A	N/A	Species or species habitat known to occur within area

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Species name	Common name	Threatened status	Migratory status	Potential for interaction	
				Operational Area	EMBA
Pterodroma mollis	Soft-plumaged Petrel	Vulnerable	N/A	N/A	Species or species habitat may occur within area
Ardenna carneipes	Flesh-footed Shearwater,	N/A	Migratory	N/A	Species or species habitat likely to occur within area
Ardenna pacifica	Wedge-tailed Shearwater	N/A	Migratory	N/A	Breeding known to occur within area
Fregata minor	Great Frigatebird	N/A	Migratory	N/A	Species or species habitat may occur within area
Hydroprogne caspia	Caspian Tern	N/A	Migratory	N/A	Breeding known to occur within area
Sterna dougallii	Roseate Tern	N/A	Migratory	N/A	Breeding likely to occur within area
Thalasseus bergii	Crested Tern	N/A	Migratory	N/A	Breeding known to occur

Table 4-13: Seabird and shorebird BIAs within the Operational Area and EMBA

Species	BIA type	Approximate Distance of BIA from Operational Area (km)
Fairy tern	Breeding and foraging (North West Cape)	230 km south-west
	Breeding and foraging (Thevenard Island)	133 km south
	Breeding and foraging (Montebello Islands)	40 km south-east
	Breeding and foraging (Barrow Island)	66 km south
Roseate tern	Foraging (Lowendal Islands)	41 km south-east
	Foraging (Pilbara north islands)	90 km south
	Breeding (Pilbara north islands)	111 km south

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Species	BIA type	Approximate Distance of BIA from Operational Area (km)
Wedge-tailed shearwater	Breeding (Montebello Island, Lowendal Island Barrow Island)	Overlaps
	Breeding (Pilbara southern and middle islands)	37 km south
	Breeding (Dampier Archipelago)	41 km east

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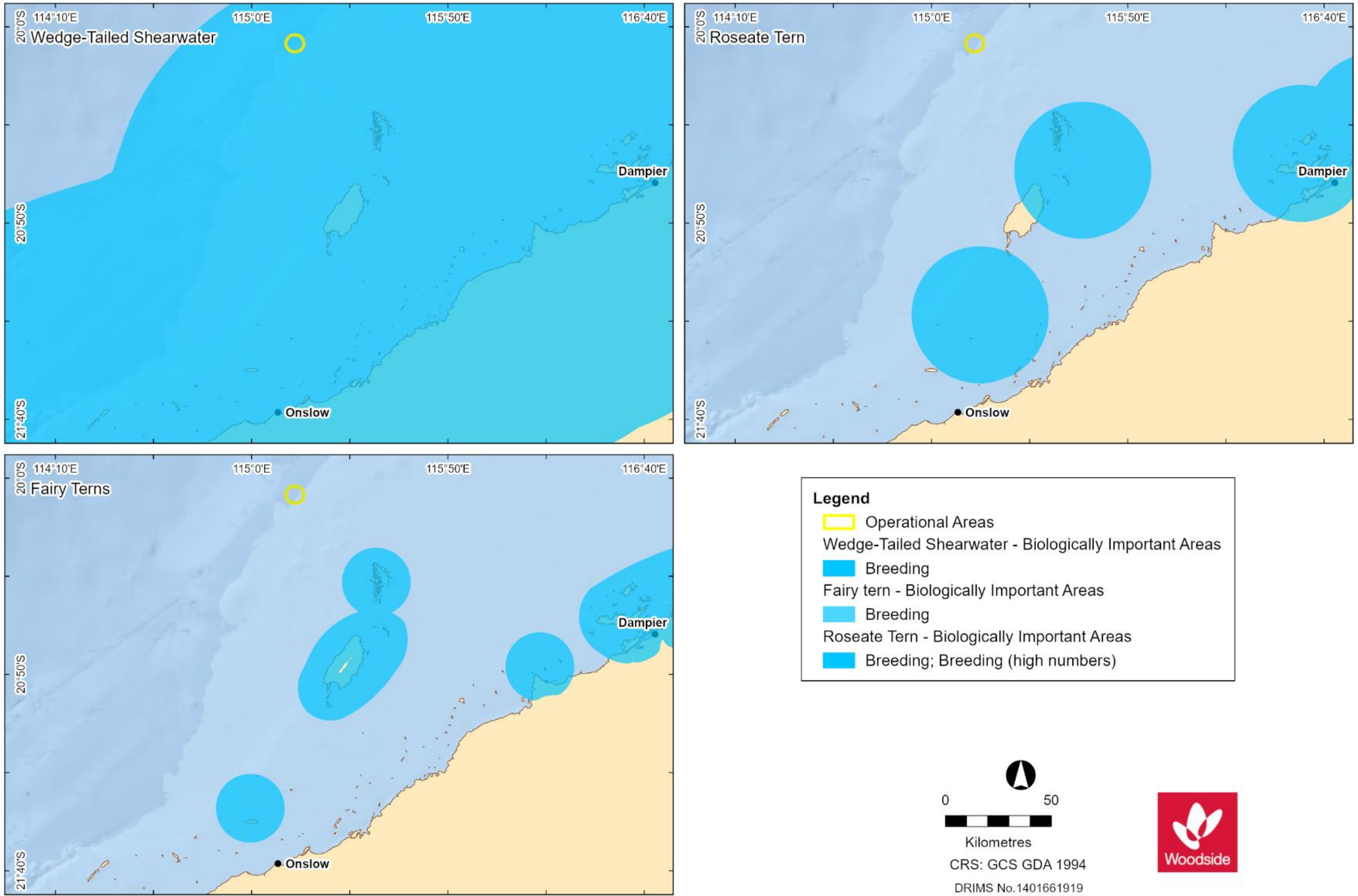

Sources: Esri, Garmin, GEBCO, NOAA NGDC, and other contributors

Figure 4-9: Seabird BIAs

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4.5.2.5 Seasonal Sensitivities for Protected Species

Seasonal sensitivities for protected migratory species identified as potentially occurring within the Operational Area are identified in **Table 4-14**. Movement patterns of all protected species identified in **Section 4.5.2** are described in **Appendix H**.

Table 4-14: Key seasonal sensitivities for protected migratory species identified as occurring within the Operational Area.

Species	January	February	March	April	May	June	July	August	September	October	November	December
Fish, Sharks and Rays												
Manta rays – presence/ aggregation/breeding (Ningaloo)[1]			🟨	🟨	🟨	🟨	🟨	🟨				
Whale shark* – foraging/ aggregation near Ningaloo[2]			🟨	🟧	🟧	🟨	🟨	🟨	🟨	🟨	🟨	
Mammals												
Blue whale – northern migration (Exmouth, Montebello, Scott Reef)[5]				🟨	🟧	🟧	🟨					
Blue whale – southern migration (Exmouth, Montebello, Scott Reef)[6]	🟨									🟨	🟧	🟧
Humpback whale – northern migration (Jurien Bay to Montebello)[7]					🟨	🟧	🟧	🟨	🟨	🟨	🟨	
Humpback whale – southern migration (Jurien Bay to Montebello)[8]								🟨	🟨	🟨	🟨	
Marine Reptiles												
Green turtle – various nesting areas within EMBA[3]	🟧	🟧	🟨								🟨	🟨
Flatback turtle – various nesting areas within EMBA[3]	🟧	🟨	🟨							🟨	🟨	🟧
Loggerhead turtle – various nesting areas within EMBA[3]	🟧	🟨	🟨							🟨	🟨	🟧

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Species	January	February	March	April	May	June	July	August	September	October	November	December
Hawksbill turtles – various nesting areas within EMBA[3]	🟧	🟨								🟨	🟨	🟧
Seabirds and shorebirds												
Caspian tern – breeding (Ningaloo)[9]						🟨	🟨	🟨	🟨	🟨	🟨	
Crested tern – breeding (Ningaloo)[9]			🟨	🟨	🟨	🟨	🟨	🟨				
Fairy tern – breeding (Ningaloo)[9]							🟨	🟨	🟨			
Osprey – breeding (Ningaloo)[9]				🟨	🟨	🟨	🟨	🟨	🟨	🟨		
Roseate tern – breeding (Ningaloo)[9]								🟨	🟨	🟨	🟨	🟨
Wedge-tailed shearwater – various breeding sites[9]	🟨	🟨	🟨	🟨				🟨	🟨	🟨	🟨	🟨
🟨	Species may be present in the Operational Area											
🟧	Peak period. Presence of animals is reliable and predictable each year											

References for species seasonal sensitivities:

1. *Environment Australia, 2002*
2. *CALM, 2005; Environment Australia, 2002*
3. *Commonwealth of Australia, 2017; Chevron, 2015; CALM, 2005; DSEWPaC, 2012a*
4. *Commonwealth of Australia, 2017; Chevron, 2015*
5. *DSEWPaC, 2012a; McCauley and Jenner, 2010; McCauley, 2011*
6. *DSEWPaC, 2012a; McCauley and Jenner, 2010*
7. *CALM, 2005; Environment Australia, 2002; Jenner et al., 2001a; McCauley and Jenner, 2001*
8. *McCauley and Jenner, 2001*
9. *DSEWPaC, 2012b; 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)*

4.5.3 Key Ecological Features (KEFs)

KEFs within the Operational Area and EMBA are identified in **Table 4-15** and described in **Appendix H**. **Figure 4-10** shows the spatial overlap with KEFs and the Operational Area and EMBA.

Table 4-15: KEFs within the Operational Area and EMBA.

Key Ecological Feature	Distance from Operational Area to KEF (km)
Ancient Coastline at 125 m Depth Contour	Overlaps
Continental Slope Demersal Fish Communities	5 km north-west
Exmouth Plateau	93 km north-west

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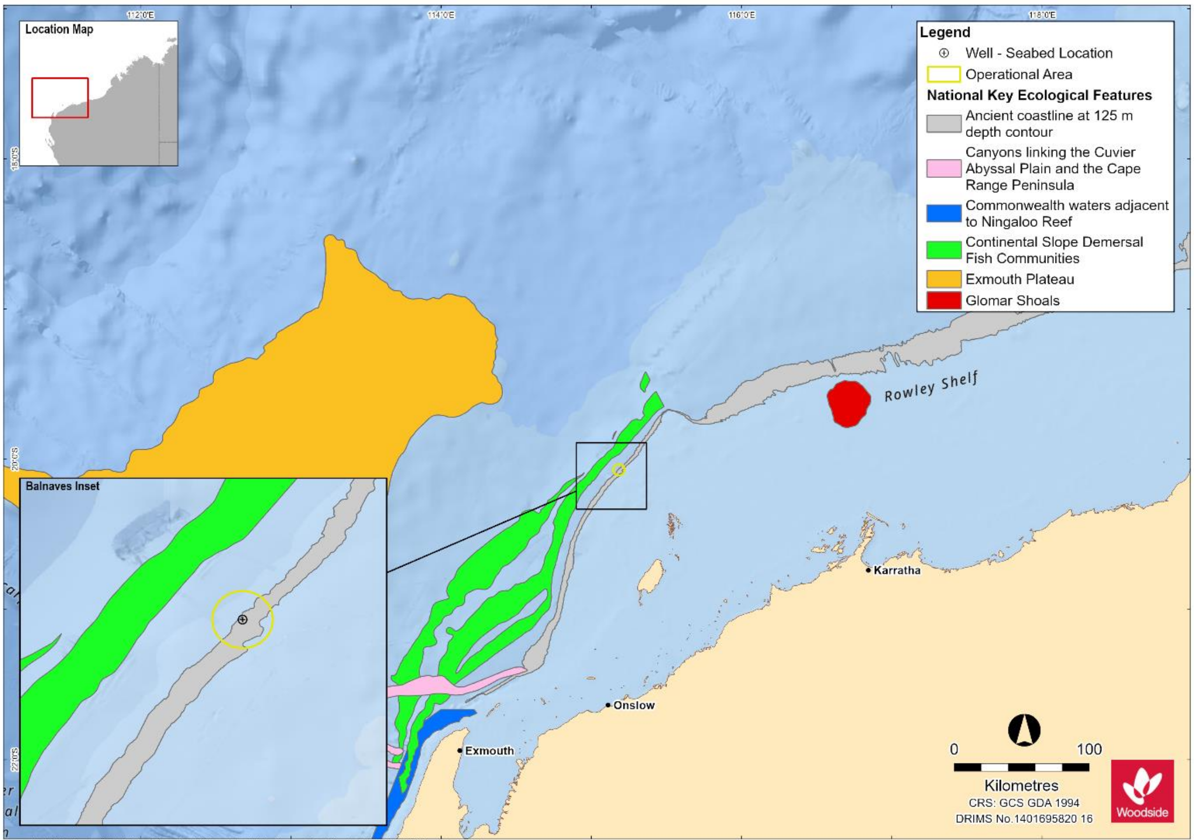
Key Ecological Feature	Distance from Operational Area to KEF (km)
Canyons linking the Cuvier Abyssal Plain and the Cape Range Peninsula	155 km south-west
Commonwealth Waters adjacent to Ningaloo Reef	200 km south-west



Sources: Esri, HERE, Garmin, GEBCO, National Geographic, NOAA, and the GIS User Community, Esri, Garmin, GEBCO, NOAA NGDC, and other contributors

Figure 4-10: KEFs overlapping the Operational Area and EMBA

4.5.4 Protected Places

No protected places overlap the Operational Area. Protected places within the EMBA are identified in **Table 4-16** and presented in **Figure 4-11**. **Appendix H** outlines the values and sensitivities of protected places and other sensitive areas in the Operational Area and EMBA.

Table 4-16: Established protected places and other sensitive areas overlapping the EMBA

	Distance from Operational Area to protected place or sensitive area (km)	IUCN category* or relevant park zone overlapping the Operational Area and/or EMBA
Australian Marine Parks (AMPs)		
NWMR		
Montebello AMP	3 km east	Multiple Use Zone (IUCN VI)
Gascoyne AMP	163 km south-west	Multiple Use Zone (IUCN VI)
Ningaloo AMP	203 km south-west	Recreational Use Zone (IUCN IV)
State Marine Parks and Nature Reserves		

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	Distance from Operational Area to protected place or sensitive area (km)	IUCN category* or relevant park zone overlapping the Operational Area and/or EMBA
Marine Parks		
Montebello Islands Marine Park, Barrow Island (State Nature Reserves, Marine Park and Marine Management Area) (jointly managed)	36 km south-east	Sanctuary, Recreation, General Use and Special Purpose Zones
Ningaloo Marine Park and Muiron Islands Marine Management Area (jointly managed)	180 km south-west	Sanctuary, Recreation, General Use and Special Purpose Zones
Marine Management Areas		
Muiron Islands	180 km south-west	Sanctuary Zone (IUCN Ia) Multiple Use Zone (IUCN VI)
Fish Habitat Protection Areas		
None identified	N/A	N/A
Nature Reserves		
Montebello Islands Marine Park/Barrow Island Marine Park/Barrow Island Marine Management Area	40 km south	Sanctuary Zone (IUCN Ia)
Lowendal Island	71 km south	Sanctuary Zone (IUCN Ia)
Pilbara Islands – South, Middle and Northern Island Groups	149 km south	Sanctuary Zone (IUCN Ia)
Muiron Islands	186 km south-west	Sanctuary Zone (IUCN Ia)

**Conservation objectives for IUCN categories include:*

Ia: Strict Nature Reserve

Ib: Wilderness Area

II: national Park

III: Natural Monument or Feature

IV: Habitat/Species Management Area

V: Protected Landscape

VI: Protected area with sustainable use of natural resources – allow human use but prohibits large scale development.

IUCN categories for the marine park are provided and, in brackets, the IUCN categories for specific zones within each Marine Park as assigned under the North-west Marine Parks Network Management Plan 2018 and South-west Marine Parks Network Management Plan 2018.

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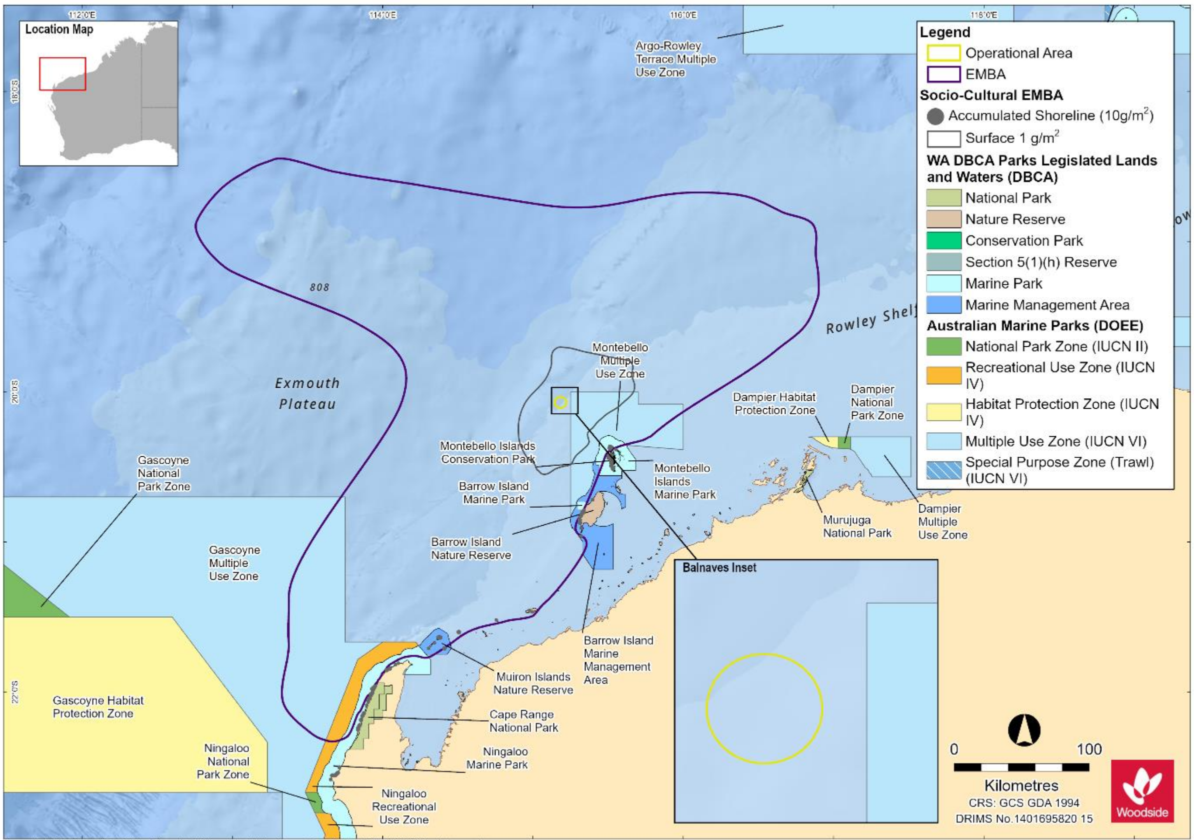

Sources: Esri, HERE, Garmin, GEBCO, National Geographic, NOAA, and the GIS User Community, Esri, Garmin, GEBCO, NOAA NGDC, and other contributors

Figure 4-11: Protected Areas overlapping the EMBA

4.6 Socio-Economic Environment

4.6.1 Cultural Heritage

4.6.1.1 European and Indigenous Sites of Significance

There are no known sites of European cultural heritage significance within the Operational Area. **Appendix H** describes cultural heritage sites within the EMBA.

Indigenous Australian people have a strong continuing connection with the area that extends back some 50,000 years. Woodside acknowledges this unique connection between Aboriginal peoples and the land and sea in which the company operates. Woodside also understands that while marine resources used by Indigenous people is generally limited to coastal waters for activities such as fishing, hunting and maintenance of culture and heritage, many Aboriginal groups have a direct cultural interest in decisions affecting the management of deeper offshore waters. In particular, the Yinggarda, Baiyungu and Thalanyji Peoples have direct interest in the operation and impacts of the Balnaves well plug and abandonment as Traditional Owners of the area overlapped by the socio-cultural EMBA.

There are no known Indigenous sites of significance within the Operational Area. Within the EMBA, the North West Cape and the adjacent coastline has a long history of occupancy by Aboriginal communities. The longstanding relationship between Aboriginal people and the land and sea is prevalent in Indigenous culture today and Indigenous heritage places including archaeological sites which are protected under the *Aboriginal Heritage Act 1972* (WA) or EPBC Act.

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The Department of Aboriginal Affairs (DAA) Heritage Inquiry System was searched for the EMBA, which indicated no registered Indigenous heritage places (**Appendix G**).

4.6.1.2 Underwater Heritage

A search of the Australian National Shipwreck Database, which records all known Maritime Cultural Heritage (shipwrecks, aircraft, relics and other underwater cultural heritage) in Australian waters indicated that there are no sites within the Operational Area. The Australian National Heritage Database places four wrecks at a location about 3 km north-west of the Operational Area (the *Wild Wave* (China), the *Curlew*, the *Marietta* and the *Vianen*); however, the stated location for these wrecks are at the Montebello Islands or Barrow Island. Therefore, there are no Maritime Cultural Heritage sites within 10 km of the Operational Area.

4.6.1.3 World, National and Commonwealth Heritage Listed Places

No listed heritage places overlap the Operational Area. World, National and Commonwealth heritage places within the EMBA are identified in **Table 4-17**. **Appendix H: Section 10** outlines the values and sensitivities of these places.

Table 4-17: World, National and Commonwealth Heritage Listed Places within the EMBA

Listed Place	Distance from Operational Area to Listed Place (km)
World Heritage Properties (WHP)	
Ningaloo Coast World Heritage Property	Located 183 km south-west of the Operational Area.
National Heritage Places (NHP)	
Ningaloo Coast National Heritage Place	Located 35 km south-east of the Operational Area.
Commonwealth Heritage Places (CHP)	
None	There are no Commonwealth Heritage Places located within the EMBA.

4.6.2 Commercial Fisheries

A number of Commonwealth and State fishery management areas are located within the Operational Area and EMBA. FishCube data was requested to analyse the potential for interaction of fisheries with the Operational Area, which was used to determine consultation with State Fisheries who may be impacted by proposed petroleum activities (Department of Primary Industries and Regional Development [DPIRD], 2021). **Table 4-17** provides an assessment of the potential interaction and **Appendix H** provides further detail on the fisheries that have been identified through desk-based assessment and consultation (**Section 5**). **Figure 4-12** shows fisheries identified as having a potential interaction with the Petroleum Activities Program.

Table 4-18: Commonwealth and State commercial fisheries overlapping the Operational Area

Fishery	Potential for interaction within Operational Area	
Commonwealth Managed Fisheries		
Southern Bluefin Tuna Fishery	×	While there is an overlap with the fishery management area and the Operational Area, Woodside considers there to be no potential for interaction with this fishery and the Petroleum Activities Program given the current distribution of fishing effort is focused in the Great Australian Bight.

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Fishery	Potential for interaction within Operational Area	
Western Skipjack Tuna Fishery	×	While there is an overlap with the fishery management area and the Operational Area, Woodside considers there to be no potential for interaction with this fishery and the Petroleum Activities Program given there have been no active vessels since 2009.
Western Tuna and Billfish Fishery	×	While there is an overlap with the fishery management area and the Operational Area, Woodside considers there to be no potential for interaction with this fishery and the Petroleum Activities Program given the current distribution of fishing effort is concentrated south of Carnarvon, far beyond the Operational Area.
State Managed Fisheries		
Pilbara Line Fishery	✓	The Operational Area is located within a 60 nm CAES block (20150) that has reported up to six vessels active in the block each year between 2009 and 2019. Catch volumes were reported to be between 24,350 and 52,523 kg for the entire block. Woodside therefore considers there is a possibility that interactions with the fishery will occur during the Petroleum Activities Program.
Pilbara Trap Managed Fishery	✓	The Operational Area is located within a 60 nm CAES block (20150) that has reported up to three vessels active in the block each year between 2009 and 2019. In the three years where there were three vessels active (2010, 2012 and 2018), catch volumes were reported to be between 62,715 and 78,236 kg for the entire block. Additionally, through consultation fishers have reported setting traps in waters greater than 50 m deep and therefore interactions may occur within the Operational Area during the Petroleum Activates Program.
Pilbara Fish Trawl (Interim) Managed Fishery	×	The Operational Area is located within an area of the fishery that is closed to trawling. The Operational Area is located on the border of two 10 nm CAES blocks (200150 and 200151), neither of which have reported fishing effort from the Pilbara Fish Trawl (Interim) Managed Fishery between 2009 and 2019. Therefore, while there is an overlap with the fishery management area and the Operational Area, Woodside considers there to be no potential for interaction with this fishery and the Petroleum Activities Program.
Mackerel Managed Fishery (Area 2)	×	The Operational Area is located on the border of two 10 nm CAES blocks (200150 and 200151), neither of which have reported fishing effort from the Mackerel Managed Fishery between 2009 and 2019. Therefore, while there is an overlap with the fishery management area and the Operational Area, Woodside considers there to be no potential for interaction with this fishery and the Petroleum Activities Program.
Onslow Prawn Managed Fishery	×	The Operational Area is located on the border of two 10 nm CAES blocks (200150 and 200151), neither of which have reported fishing effort from the Onslow Prawn Managed Fishery between 2009 and 2019. Therefore, while there is an overlap with the fishery management area and the Operational Area, Woodside considers there to be no potential for interaction with this fishery and the Petroleum Activities Program.
West Coast Deep Sea Crustacean Managed Fishery	×	The West Coast Deep Sea Crustacean Managed Fishery can fish in waters deeper than the 150 m isobath and therefore partially overlaps the Operational Area. However, the fishery mostly fishes at depths between 500 and 800 m and effort is concentrated between Carnarvon and Fremantle. Therefore, interactions with the fishery are not expected during the Petroleum Activities Program.
Specimen Shell Managed Fishery	×	This fishery currently uses hand collection methods to collect shells in water depths less than 30 m. Therefore, no effort occurs within the Operational Area and Woodside considers there to be no potential for interaction with this fishery and the Petroleum Activities Program.
Marine Aquarium Managed Fishery	×	This fishery generally collects fish for display in water depths less than 30 m. Therefore, no effort occurs within the Operational Area and Woodside considers there to be no potential for interaction with this fishery and the Petroleum Activities Program.

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Fishery	Potential for interaction within Operational Area	
Pilbara Crab Managed Fishery	×	This fishery currently fishes using traps in water depths less than 50 m. Therefore, no effort occurs within the Operational Area and Woodside considers there to be no potential for interaction with this fishery and the Petroleum Activities Program.
South West Coast Salmon Managed Fishery	×	No fishing occurs north of the Perth metropolitan area. Therefore, no effort occurs within the Operational Area and Woodside considers there to be no potential for interaction with this fishery and the Petroleum Activities Program.
Beche-de-mer Fishery	×	The target species typically inhabit nearshore waters and no effort occurs within the Operational Area. Therefore, while there is an overlap with the fishery management area and the Operational Area, Woodside considers there to be no potential for interaction with this fishery and the Petroleum Activities Program.
Abalone Fishery	×	Shark Bay is considered the northern range limit for the commercial abalone species (DoF, 2004) and therefore operates outside of the Operational Area

Commonwealth Fisheries not overlapping with the Operational Area but occurring within the EMBA and socio-cultural EMBA are described in **Appendix H: Section 11.5.1** and include the:

- Western Deepwater Trawl Fishery
- North West Slope Trawl Fishery.

State Fisheries not overlapping with the Operational Area but occurring within the EMBA and socio-cultural EMBA are described in **Appendix H: Section 11.5.1** and include the:

- Nickol Bay Prawn Managed Fishery
- Exmouth Prawn Managed Fishery

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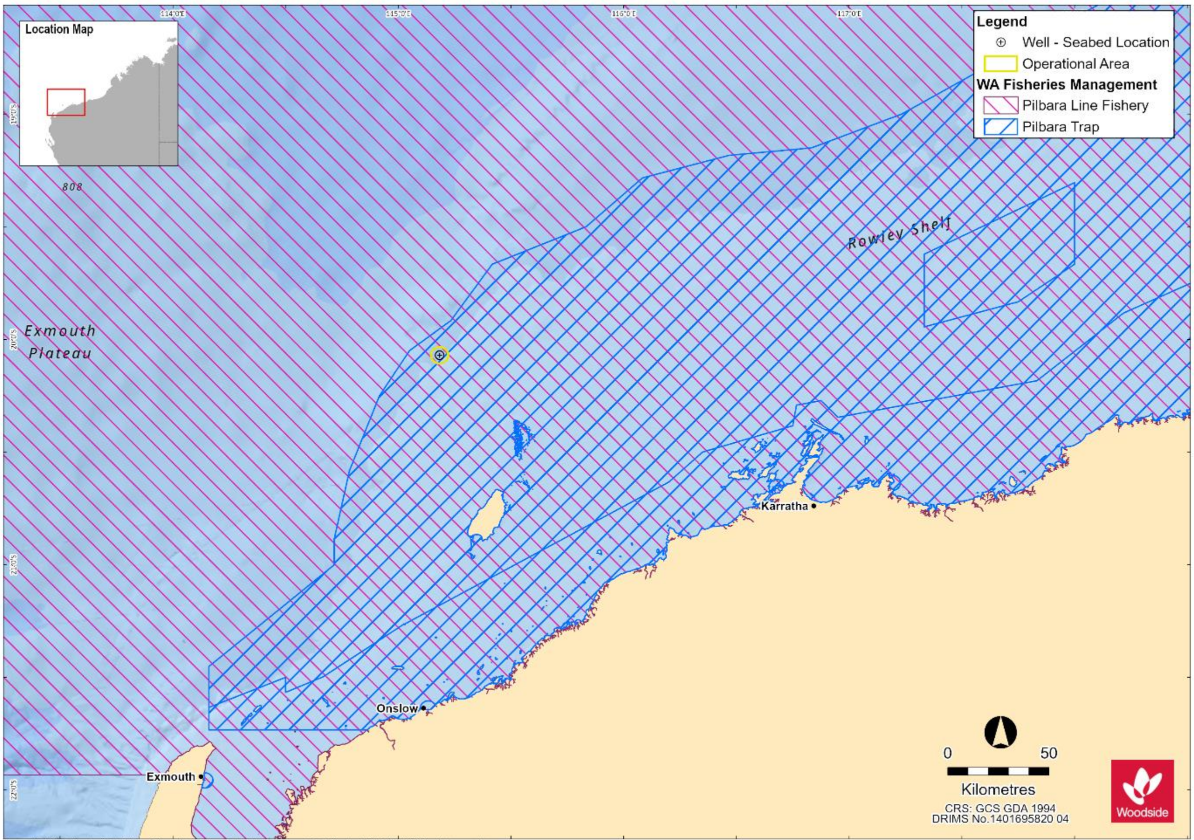

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Figure 4-12: Commercial fisheries overlapping the Operational Area with a potential for interaction with the Petroleum Activities Program

4.6.3 Traditional Fisheries

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 Western Australia coastline.

4.6.4 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 Western Australia. 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 North West 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. Recreational charter fishing effort data is captured by DPIRD at a resolution of 5 x 5 nm blocks. The Operational Area overlaps

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with four of these blocks: 204BJ, 204BK, 203BJ and 203BK. FishCube data for tour operators was analysed for the period of 2015 – 2019. Over this time period no recreational fishing charters reported effort within the CAES blocks overlapping the Operational Area. Occasional recreational fishing occurs at Rankin Bank (located about 45 km from the Operational Area, respectively). The Montebello Islands (43 km from the Operational Area) are the next closest location for tourism, with some charter boat operators taking visitors to these remote islands.

Within the EMBA, tourism is one of the major industries of the Gascoyne region and contributes significantly to the local economy in terms of both income and employment. The main marine nature-based tourist activities are concentrated around and within the Ningaloo Marine Park and North West Cape area. Activities include recreational fishing, snorkelling and scuba diving, whale shark encounters (April to August) and manta rays (September to November), whale watching (July to October) and turtle watching (all year round) (Shire of Exmouth). Recreational use of the Ningaloo Marine Park varies in intensity throughout the year, depending on school holidays and seasonal peaks of marine fauna being observed. Coral Bay is documented as one of the most heavily used areas (MPRA, 2005).

4.6.5 Commercial Shipping

The Australian Maritime Safety Authority (AMSA) has introduced a network of shipping fairways across the NWMR off WA to reduce the risk of vessel collisions with offshore infrastructure. It is noted that none of these fairways intersect with the Operational Area; the nearest fairway is approximately 37 km north-east of Operational Area (**Figure 4-13**). Vessel tracking data suggest shipping is concentrated to the north-east of the Operational Area, which is associated with vessels transiting between ports.

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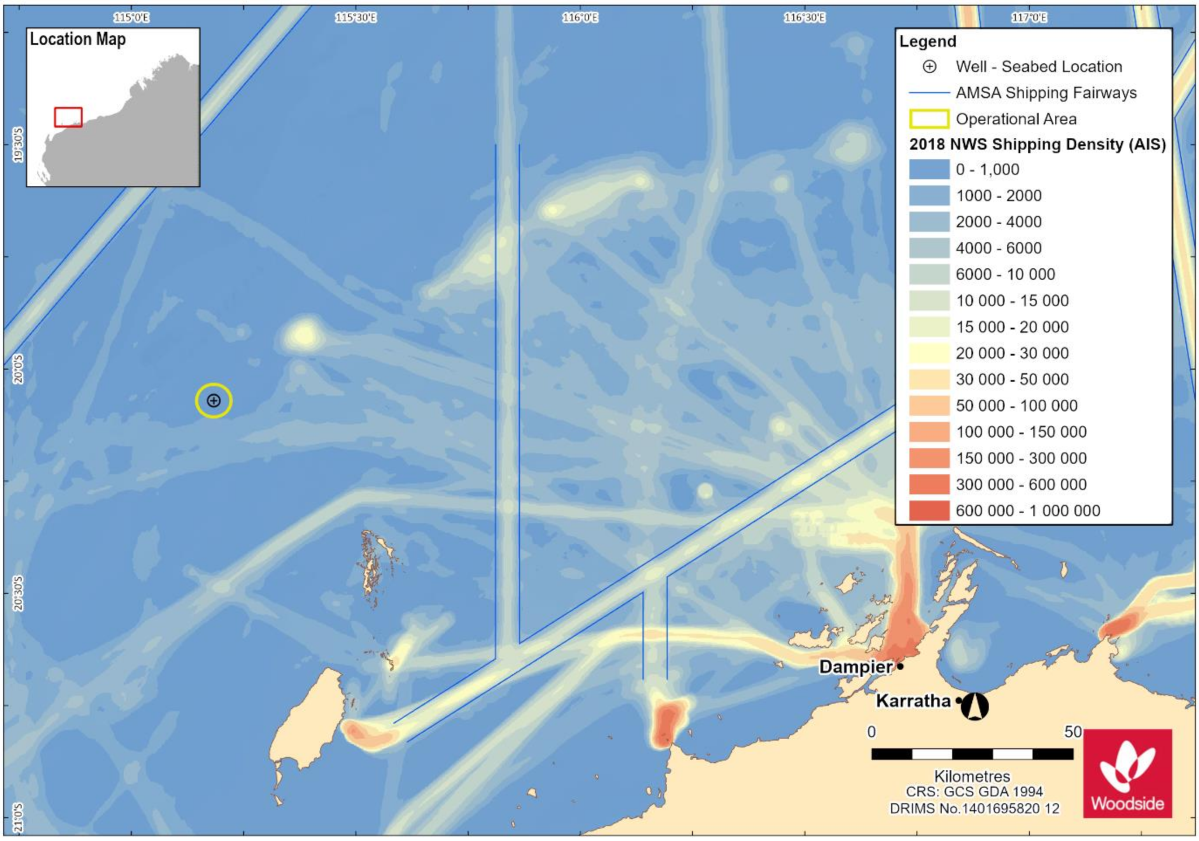

Figure 4-13: Vessel density map for the Operational Area and EMBA, derived from AMSA satellite tracking system data (vessels include cargo, LNG tanker, passenger vessels, support vessels, and others/unnamed vessels)

4.6.6 Oil and Gas

The Operational Area is situated within an area of established oil and gas operations, with additional infrastructure in the broader North West Shelf region. The Operational Area for the activity overlaps with the 44” (1.1 m) diameter Chevron-operated gas pipeline from the Wheatstone offshore facilities to the LNG plant at Ashburton on the mainland. The Wheatstone gas pipeline is located about 1.8 km from the closest Balnaves well. The Operational Area also overlaps with the Woodside-operated Julimar Phase 2 Development (JDP2) flowline and umbilical. The umbilical is located about 2.5 km away from the closest Balnaves well and the flowline is located about 2.6 km from the closest well. **Table 4-19** details other oil and gas facilities located within 50 km of the Operational Area. **Appendix H** describes current oil and gas development within the EMBA, also shown in **Figure 4-14**.

Table 4-19: Other Oil and Gas Facilities located within 50 km of the Operational Area

Facility Name and Operator	Distance from Operational Area to Listed Place (km)
Pluto Platform (operated by Woodside)	14 km north-east
Wheatstone Platform (operated by Chevron)	22 km north-east
John Brookes (operated by Santos WA Southwest P/L)	39 km south-east

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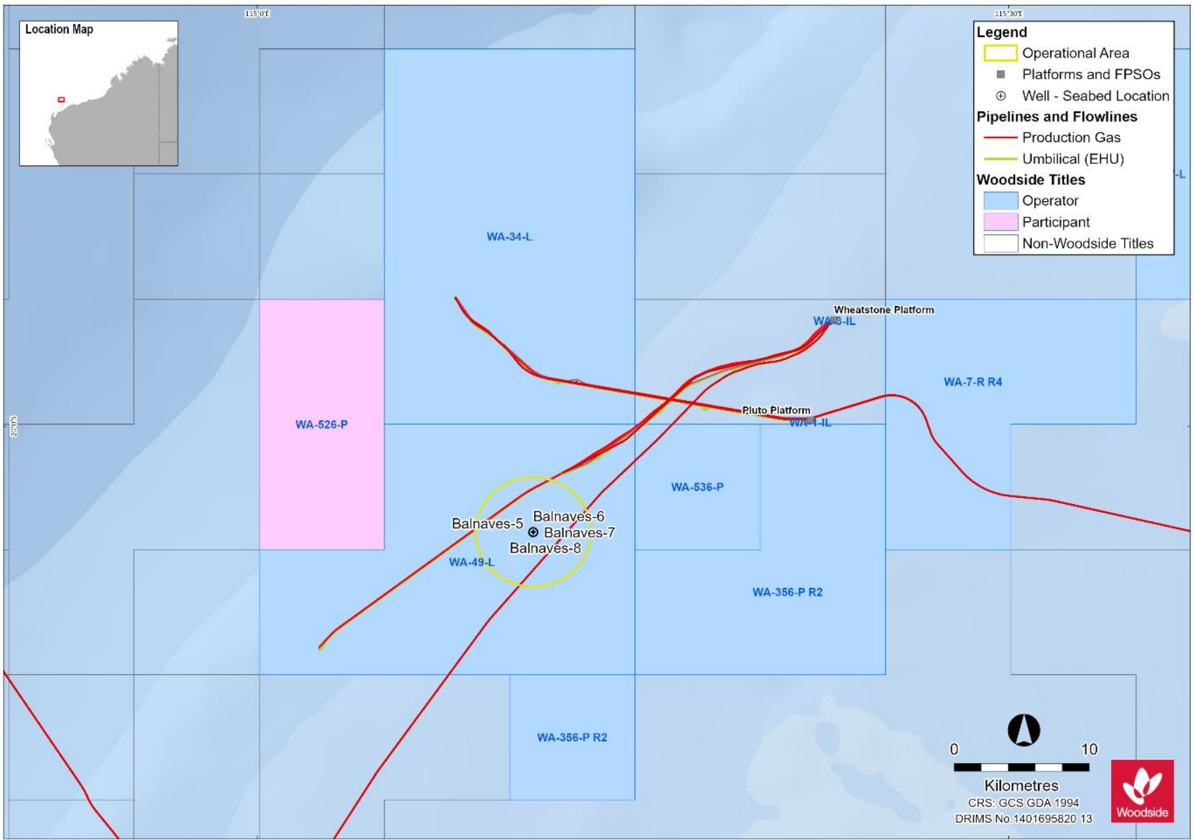

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Figure 4-14: Oil and gas Infrastructure within the Operational Area and region

4.6.7 Defence

There are designated defence practice areas in the offshore marine waters off Ningaloo and 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 4-15**). The closest site where unexploded ordinance is known to occur is 8 km east of Trimouille Island in depths of about 40 m, located approximately 60 km south east of the Operational Area. Defence areas overlapping the Operational Area and EMBA are presented in **Figure 4-15**.

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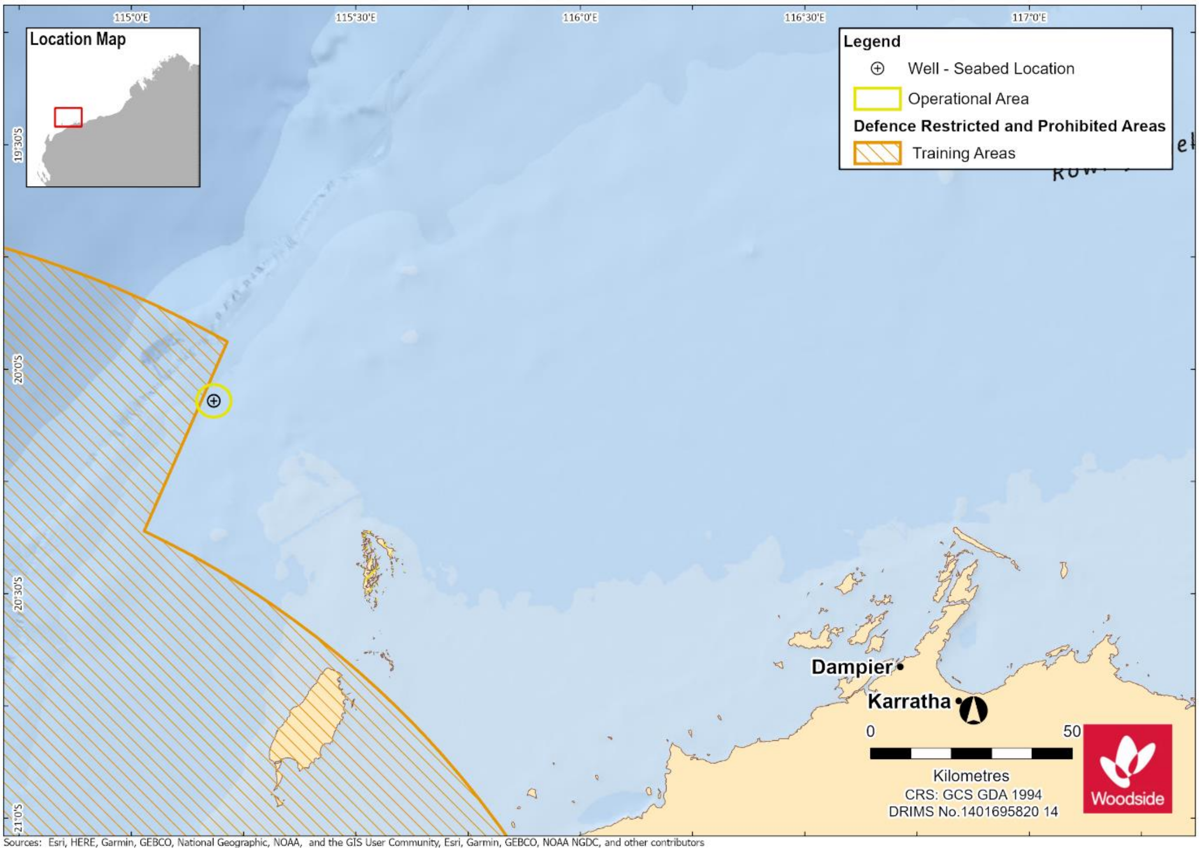

Figure 4-15: Defence areas within the Operational Area and EMBA

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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 – June 2021*
- *GN1847 - Responding to public comment on environment plans - September 2020*
- *GN1344 - Environment plan content requirements - September 2020*

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- *GN1488 - Oil pollution risk management - February 2021*

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.

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

Stakeholder	Relevant to activity	Reasoning
Commonwealth Government department or agency		
Australian Border Force (ABF)	Yes	Responsible for coordinating maritime security.
Australian Fisheries Management Authority (AFMA)	No	Responsible for managing Commonwealth fisheries. No Commonwealth Fisheries are active in the Operational Area.
Australian Hydrographic Office (AHO)	Yes	Responsible for maritime safety and Notices 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, Water and the Environment (DAWE)	Yes	Responsible for implementing Commonwealth policies and programs to support agriculture, water resources, the environment and our heritage. The proposed activity has the potential impact to DAWE's interests in the prevention of introduced marine species. No Commonwealth Fisheries are active in the Operational Area.
Department of Defence (DoD)	Yes	Responsible for defending Australia and its national interests. The proposed Operational Area overlaps the Defence training area.
Department of Industry, Science, Energy and Resources (DISER)	Yes	Department of relevant Commonwealth Minister and is required to be consulted under the Regulations.
Director of National Parks (DNP)	Yes	Responsible for managing AMPs and therefore requires an awareness of activities that occur within AMPs, and an understanding of potential impacts and risks to the values of parks (NOPSEMA guidance note: N-04750-GN1785 A620236, June 2020). Titleholders are required to consult DNP on offshore petroleum and greenhouse gas exploration activities if they occur in, or may impact on the values of marine parks, including where potential spill response activities may occur in the event of a spill (i.e. scientific monitoring).

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Stakeholder	Relevant to activity	Reasoning
WA Government department or agency		
Department of Biodiversity, Conservation and Attractions (DBCA)	No	Responsible for managing WA 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.
Department of Primary Industries and Regional Development (DPIRD)	Yes	Responsible for managing State fisheries. Potential for interaction during proposed activities with the Pilbara Line and Pilbara Trap Fisheries in the Operational Area.
Department of Transport (DoT)	Yes	Legislated responsibility for oil pollution response in State waters. Proposed activity has a hydrocarbon spill risk, which may require DoT response in State waters.
Commonwealth fisheries*		
North-West Slope Trawl Fishery	No	No Commonwealth Fisheries are active in the Operational Area.
Australian Southern Bluefin Tuna Fishery	Yes	While there is an overlap with the fishery management area and the Operational Area, Woodside considers there to be no potential for interaction with this fishery and the Petroleum Activities Program given the current distribution of fishing effort is focused in the Great Australian Bight. At the request of WAFIC, Woodside has consulted with Australian Southern Bluefish Tuna Industry Association.
Western Tuna and Billfish Fishery	No	While there is an overlap with the fishery management area and the Operational Area, Woodside considers there to be no potential for interaction with this fishery and the Petroleum Activities Program given the current distribution of fishing effort is concentrated south of Carnarvon, far beyond the Operational Area. Future interactions with the fishery and infrastructure left in-situ are not expected given the species' pelagic distribution and the fishing methods utilised by the fishery.
Western Deepwater Trawl Fishery	No	No Commonwealth Fisheries are active in the Operational Area.
Western Skipjack Tuna Fishery	No	The fishery has not been active in the Operational Area since 2009. Future interactions with the fishery should the wellheads not be able to be removed is not expected given the species' pelagic distribution and the fishing methods utilised by the fishery.

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Stakeholder	Relevant to activity	Reasoning
State fisheries*		
Mackerel Managed Fishery (Area 2)	No	Although the fishery overlaps the Operational Area, it has not been active in the Operational Area between 2009 and 2019. Future interactions with the fishery and infrastructure left in-situ are not expected given the species' pelagic distribution and the fishing methods utilised by the fishery. Fishers are not active at water depths greater than 70 m (previous WAFIC advice).
Onslow Prawn Managed Fishery	No	Although the fishery overlaps the Operational Area, it has not been active in the Operational Area between 2009 and 2019. Woodside considers there to be no potential for interaction with this fishery and the Petroleum Activities Program.
Specimen Shell Managed Fishery	No	This fishery currently uses hand collection methods to collect shells in water depths less than 30 m. Therefore, no effort occurs within the Operational Area and Woodside considers there to be no potential for interaction with this fishery and the Petroleum Activities Program.
South West Coast Salmon Managed Fishery	No	Although the fishery overlaps the Operational Area, no fishing occurs north of the Perth metropolitan area. Fishers are active south of Perth and from the beach (previous WAFIC advice).
West Coast Deep Sea Crustacean Managed Fishery	No	The West Coast Deep Sea Crustacean Managed Fishery can fish in waters deeper than the 150 m isobath and therefore partially overlaps the Operational Area. However, the fishery mostly fishes at depths between 500 and 800 m and effort is concentrated between Carnarvon and Fremantle. Therefore, interactions with the fishery are not expected during the Petroleum Activities Program.
Pilbara Crab Managed Fishery	No	This fishery currently fishes using traps in water depths less than 50 m. Therefore, no effort occurs within the Operational Area and Woodside considers there to be no potential for interaction with this fishery and the Petroleum Activities Program.
Beche-de-mer Fishery	No	The target species typically inhabit nearshore waters and no effort occurs within the Operational Area. Therefore, while there is an overlap with the fishery management area and the Operational Area, Woodside considers there to be no potential for interaction with this fishery and the Petroleum Activities Program. This is a dive and wade fishery, with activities generally restricted to waters less than 30 m deep (previous WAFIC advice).

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Stakeholder	Relevant to activity	Reasoning
Abalone Fishery	No	Shark Bay is considered the northern range limit for the commercial abalone species (DoF, 2004) and therefore operates outside of the Operational Area.
Marine Aquarium Fishery	No	It is a dive and wade fishery with activities generally restricted to waters less than 30 m deep (previous WAFIC advice).
Pilbara Demersal Scalefish Fishery • Pilbara Trawl Fishery	No	The Operational Area is located within an area of the fishery that is closed to trawling. Woodside has not consulted with licence holders (WAFIC advice).
• Pilbara Trap Fishery	Yes	The fishery overlaps the Operational Area and DPIRD data indicate active fishing within the Operational Area
• Pilbara Line Fishery	Yes	The fishery overlaps the Operational Area and DPIRD data indicate active fishing within the Operational Area.
Industry		
Chevron	Yes	Adjacent Titleholder/Operator.
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)	No	Represents the interests of commercial fishers with licences in Commonwealth waters. No Commonwealth Fisheries are active 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 WA. Activities do not have the potential to impact recreational fishers.
Marine Tourism WA	No	Represents the interests of recreational fishers in WA. Activities do not have the potential to impact recreational fishers.
WA Game Fishing Association	No	Represents the interests of charter owners and operators in WA. Activities do not have the potential to impact game fishers.

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Stakeholder	Relevant to activity	Reasoning
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 and Pilbara Trap Fisheries.

** 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.* ***Section 4.6.2*** *provides a detailed assessment of Commonwealth and State fisheries within or adjacent to the Operational Area.*

5.5 Stakeholder Consultation Plan

Consultation activities undertaken for the proposed activity and a summary of feedback are outlined in **Table 5-2**.

In addition, Woodside published a consultation Information Sheet at www.woodside.com.au/sustainability/transparency/consultation-activities and provided a toll-free 1800 phone number to support consultation activities.

Table 5-2: Assessment stakeholder consultation feedback

Stakeholder	Information provided	Stakeholder response	Woodside response	Woodside assessment and outcome
Australian Government department or agency				
ABF	On 8 March 2021, Woodside emailed ABF advising of the proposed activity (**Appendix F**, reference 1.1) and provided a Consultation Information Sheet.	No feedback received.	No response required.	Woodside has addressed maritime security-related issues in **Section 6** of this EP based on previous offshore activities. Woodside considers this adequately addresses stakeholder interests and no further consultation is required.

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Stakeholder	Information provided	Stakeholder response	Woodside response	Woodside assessment and outcome
AHO	On 8 March 2021, Woodside emailed AHO advising of the proposed activity (**Appendix F,** reference 1.3) and provided a shipping lane map (**Appendix F**, reference 1.4) and a Consultation Information Sheet.	No feedback received.	No response required.	Woodside will notify the AHO no less than four working weeks before operations commence, as referenced as a **Control 1.1** in this EP. Woodside considers this adequately addresses stakeholder interests and no further consultation is required.
AMSA (marine safety)	On 8 March 2021, Woodside emailed AMSA advising of the proposed activity (**Appendix F**, reference 1.3) and provided a shipping lane map (**Appendix F**, reference 1.4) and a Consultation Information Sheet.	On 10 March 2021, AMSA emailed Woodside requesting that the Australian Hydrographic Office (AHO) be contacted through datacentre@hydro.gov.au no less than four weeks before operations commence for the promulgation of related notices to mariners. AMSA requested Woodside contact AMSA's Joint Rescue Coordination Centre (JRCC) at least 24–48 hours before operations commence and provided details of information required by the JRCC in that communication. AMSA also advised the JRCC will also need to be advised when operations start and end. AMSA reminded Woodside of its obligations to comply with the International Rules for Preventing Collisions at Sea and provided advice on obtaining vessel traffic plots, including digital datasets and maps.	On 8 April 2021, Woodside responded and noted AMSA's requests. On 29 April 2021, Woodside emailed AMSA and confirmed it will contact/notify JRCC when operations end. Woodside also asked for clarification on 'update of progress'.	Woodside has addressed AMSA's requests: Woodside will notify AMSA's JRCC at least 24-48 hours before operations commence, when operations start and end and provide updates to both the AHO and AMSA on any changes to planned activities, as referenced as **Controls 1.3** and **1.4** in this EP. Woodside will notify the AHO no less than 4 weeks before operations commence, as referenced as a **Control 1.1** in this EP. Woodside considers this adequately addresses stakeholder interests and no further consultation is required.

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Stakeholder	Information provided	Stakeholder response	Woodside response	Woodside assessment and outcome
		On 29 April 2021, AMSA replied and noted that an update of progress refers to updates on commencement and completion of operations, as well as any delays and changes to the operation.	On 30 April 2021, Woodside reponded and thanked AMSA for the clarification.	
AMSA (Marine Pollution)	On 14 May 2021, Woodside emailed AMSA and provided a copy of the Oil Pollution First Strike Plan (Appendix F, reference 1.21)	No response received.	No response required.	Woodside has addressed oil pollution planning and response at **Appendix D and I.**
DAWE	On 8 March 2021, Woodside emailed DAWE advising of the proposed activity and provided information on invasive marine species (**Appendix F**, reference 1.5), relevant fishery maps (**Appendix F**, reference 1.6) and a Consultation Information Sheet.	On 31 March 2021, DAWE emailed Woodside, requesting to be informed of future developments, and requested that Woodside communicate future developments with AFMA and the relevant fishing industry representation organisations in the region.	On 8 April 2021, Woodside responded and noted DAWE's requests.	Woodside has consulted relevant fishery stakeholders including AFMA, WAFIC and individual relevant Licence Holder. Woodside will communicate future developments with DAWE, AFMA and WAFIC. Woodside has addressed maritime biosecurity issues in **Section 6** of this EP based on previous offshore activities. Woodside considers this adequately addresses stakeholder interests and no further consultation is required.

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Stakeholder	Information provided	Stakeholder response	Woodside response	Woodside assessment and outcome
		On 27 October 2021, DAWE emailed Woodside a letter affirming that DAWE are undertaking a review of the regulatory arrangements for abandonment of offshore oil and gas infrastructure, including consideration of the amendments to current guidelines. DAWE will consult with industry in due course regarding potential changes to approach. Based on the available information regarding the location and nature of the guidebases of four Balnaves wells and six disconnectable turret mooring anchors buried in the seabed, a sea dumping permit is required if these activities are to be undertaken.	On 3 November 2021 Woodside emailed DAWE confirming receipt of the letter and requesting a meeting to discuss this month.	Woodside is engaging in ongoing consultation with DAWE to ensure the application of the Environmental Protection (Sea Dumping) Act 1981 is met, as referenced as **Control 3.1** in this EP.
DoD	On 8 March 2021, 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.	No response required.	Woodside has provided sufficient information and opportunity to respond. Woodside considers this adequately addresses stakeholder interests and no further consultation is required.
DISER	On 8 March 2021 Woodside emailed DISER advising of the proposed activity (**Appendix F**, reference 1.1) and provided a Consultation Information Sheet.	No feedback received.	No response required.	Woodside has provided sufficient information and opportunity to respond. Woodside considers this adequately addresses stakeholder interests and no further consultation is required.

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Stakeholder	Information provided	Stakeholder response	Woodside response	Woodside assessment and outcome
DNP	On 8 March 2021, Woodside emailed DNP advising of the proposed activity (**Appendix F,** reference 1.9), considering potential risks for Australian Marine Parks, and provided a Consultation Information Sheet. On 17 March 2021, Woodside provided an update to DNP (Appendix F, reference 1.10).	On 9 April 2021, DNP responded noting planned activity does not overlap any AMPs, noting the EP guidance note, the North-west Marine Parks Network Management Plan 2018 and that DNP does not require further notification of progress in relation to the activity, unless the activity changes and overlaps or impacts a marine park. The DNP should be made aware of any incidence within a marine park.	On 12 April 2021, Woodside responded and noted DNP's feedback.	Woodside will contact DNP if details regarding the activity change and result in an overlap with or new impact to a marine park, or for emergency responses relating to oil/gas pollution. Woodside considers this adequately addresses stakeholder interests and no further consultation is required.
Western Australian Government department or agency or advisory body				
DMIRS	On 8 March 2021, Woodside emailed DMIRS advising of the proposed activity. (**Appendix F**, reference 1.1) and provided a Consultation Information Sheet.	On 26 March 2021, DMIRS responded, thanking Woodside for the consultation and acknowledging the activity. DMIRS requested commencement and cessation notifications.	On 8 March 2021, Woodside responded and noted DMIRS's feedback.	Woodside will send commencement and cessation notifications to DMIRS. Woodside considers this adequately addresses stakeholder interests and no further consultation is required.
DPIRD	On 8 March 2021, Woodside emailed DPIRD advising of the proposed activity (**Appendix F**, reference 1.13) and provided a State Fisheries map relevant to the proposed activity (**Appendix F**, reference 1.6) and a Consultation Information Sheet.	No feedback received.	No response required.	Woodside has consulted DPIRD, WAFIC, and individual relevant Licence holders. Woodside has assessed the relevancy of State fisheries issues in **Section 4.6.2** of this EP. Woodside considers this adequately addresses stakeholder interests and no further consultation is required.

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Stakeholder	Information provided	Stakeholder response	Woodside response	Woodside assessment and outcome
DoT	On 8 March 2021, Woodside emailed DoT advising of the proposed activity (**Appendix F**, reference 1.1) and provided a Consultation Information Sheet.	On 18 March 2021, DoT responded and advised that if there is a spill impacting State water from the proposed activity, then DoT should be consulted.	On 14 April 2021, Woodside responded and noted DoT's feedback	Woodside has addressed oil pollution planning and response at **Appendix D and I.** Woodside will consult DoT in the event of a spill impacting State water. Woodside considers this adequately addresses stakeholder interests and no further consultation is required.
	On 14 May 2021, Woodside emailed DoT and provided a copy of the Oil Pollution First Strike Plan (**Appendix F**, reference 1.22).	On 18 May 2021, DoT responded and informed Woodside that it would review and inform of any comments. On 18 June 2021, DoT responded, noting a request for more information on the scenarios in the First Strike Plan, clarification of a reference to the Goodwyn A Facility and marine response options. DoT also suggested a reference to stockpiles be updated.	On 24 June 2021, Woodside responded to DoT's queries with the requested information.	
		On 28 June 2021, DoT responded, noting Woodside's response and advised it had no further comment.	No response required.	
State Fisheries				
Pilbara Line Fishery	On 22 March 2021, Woodside emailed Licence Holders advising of the proposed activity and potential implications and mitigation and management measures for fishers (**Appendix F,** reference 1.18) and provided a State fisheries map relevant to proposed activity	No feedback received.	No response required.	Woodside has consulted DPIRD, WAFIC, and individual relevant Licence holders. As the representative industry body WAFIC has provided a response. Woodside has addressed WAFIC's feedback as outlined below.

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Stakeholder	Information provided	Stakeholder response	Woodside response	Woodside assessment and outcome
	(**Appendix F**, reference 1.17) and a Consultation Information Sheet.			Woodside will provide commencement and cessation notifications to licence holders. Woodside has assessed the relevancy of State fisheries issues in **Section 4.6.2** of this EP. Woodside considers this adequately addresses stakeholder interests and no further consultation is required.
Pilbara Trap Fishery	On 22 March 2021, Woodside emailed Licence Holders advising of the proposed activity and potential implications and mitigation and management measures for fishers (**Appendix F,** reference 1.19) and provided a State fisheries map relevant to proposed activity **(Appendix F**, reference 1.17) and a Consultation Information Sheet.	No feedback received.	No response required.	Woodside has consulted DPIRD, WAFIC, and individual relevant Licence holders. As the representative industry body WAFIC has provided a response. Woodside has addressed WAFIC's feedback as outlined below. Woodside will provide commencement and cessation notifications to licence holders. Woodside has assessed the relevancy of State fisheries issues in **Section 4.6.2** of this EP. Woodside considers this adequately addresses stakeholder interests and no further consultation is required.

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Stakeholder	Information provided	Stakeholder response	Woodside response	Woodside assessment and outcome
Industry				
Chevron	On 8 March 2021, Woodside emailed Chevron, as operator of adjacent titles, providing information on the proposed activity (**Appendix F,** reference 1.11), a Titles map relevant to the proposed activity (**Appendix F**, reference 1.12) and a Consultation Information Sheet.	No feedback received.	On 9 June 2021, Woodside emailed Chevron to confirm if Chevron had any feedback, and to provide more detail on the activities in relation to the Wheatstone trunkline.	
		On 10 June 2021, Chevron acknowledged receipt of previous email. Chevron requested more information including field layout and proposed mooring configurations, and of the separation distances of the mooring spread.	On 11 June 2021, Woodside responded, providing the field layout, preliminary mooring analysis and preliminary anchor locations. Woodside asked Chevron to confirm the accuracy of the calculated offset from the trunkline. On 30 June 2021, Woodside phoned Chevron to confirm receipt of 11 June email and to offer any further information. Chevron confirmed it had received the email and would respond that day.	Woodside has responded to Chevron's request for the field layout, preliminary mooring analysis and preliminary anchor locations. Woodside has calculated the accuracy of the calculated offset from the trunkline. Woodside considers this adequately addresses stakeholder interests and no further consultation is required.
		On 30 June 2021, Chevron responded, advising receipt of 11 June email and advised it will revert with requested information.	On 5 August 2021, Woodside emailed Chevron and asked for confirmation of the calculated offset from the trunkline.	

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Stakeholder	Information provided	Stakeholder response	Woodside response	Woodside assessment and outcome
Chevron		On 5 August 2021, Chevron responded with drawings of the trunkline and requested Woodside calculate the offsets based on the drawing.	On 13 August 2021, Woodside responded to Chevron, noting that the drawing did not have enough geospatial information to calculate the offsets. Woodside provided a drawing used to create a geospatial file of the as-built location, and requested Chevron confirm it is an as-built representation of the Wheatstone trunkline. Woodside advised that once this is confirmed, Woodside will be able to calculate the offset.	
		On 16 August 2021, Chevron replied and attached alignment sheets for the Wheatstone trunkline with the Balnaves Proximity.	On 24 August 2021, Woodside responded and thanked Chevron for sending the alignment sheets. Woodside noted that the sheets confirm the as-laid location is very close to the proposed location. Woodside noted that as there are only proposed location coordinates on the supplied drawings, Woodside will used the proposed trunkline alignment from the Woodside database.	
		No response required.		

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Stakeholder	Information provided	Stakeholder response	Woodside response	Woodside assessment and outcome
Industry representative organisations				
APPEA	On 8 March 2021, Woodside emailed APPEA advising of the proposed activity (**Appendix F**, reference 1.1) and provided a Consultation Information Sheet.	No feedback received.	No response required.	Woodside has provided sufficient information and opportunity to respond. Woodside considers this adequately addresses stakeholder interests and no further consultation is required.
PPA	On 8 March 2021, Woodside emailed PPA advising of the proposed activity and potential implications and mitigation and management measures for fishers (**Appendix F**, reference 1.15) and provided a State Fisheries map relevant to the proposed activity **(Appendix F**, reference 1.6) and a Consultation Information Sheet.	On 11 March 2021, PPA responded to Woodside, thanking Woodside for the notification and acknowledging the activity will not impact the fishery or its operations.	No response required.	Woodside considers this adequately addresses stakeholder interests and no further consultation is required.
WAFIC	On 9 March 2021, Woodside emailed WAFIC advising of the proposed activity and potential implications and mitigation and management measures for fishers (**Appendix F,** reference 1.14), and provided a fisheries map relevant to the proposed activity (**Appendix F,** reference 1.6) and a Consultation Information Sheet.	On 16 March 2021, WAFIC responded to Woodside, commenting that Woodside should allow four weeks when engaging with commercial fishers, and questioned whether Zone One Pilbara Trawl is over the operational area. WAFIC noted that Woodside must engage with ASBTIA and the PPA.	On 22 March 2021, Woodside responded, noting that Woodside provides four weeks for consultation with relevant licence holders. Woodside confirmed that the wellheads are not within Zone 1 of the Pilbara Trawl Fishery, however it overlaps the operational area. Woodside provided an updated fisheries map (**Appendix F,** reference 1.17).	Woodside has consulted with PPA, ASBTIA, Pilbara Trap licence holders and Pilbara Line licence holders. Woodside will provide commencement and cessation notifications to WAFIC and Pilbara Trap and Pilbara Line licence holders.

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Stakeholder	Information provided	Stakeholder response	Woodside response	Woodside assessment and outcome
		On 22 March 2021, WAFIC responded and confirmed that Pilbara Trawl licence holders do not need to be consulted.	No response required.	Woodside considers this adequately addresses stakeholder interests and no further consultation is required.
Australian Southern Bluefin Tuna Industry Association	On 22 March 2021, Woodside emailed ASBTIA advising of the proposed activity (**Appendix F,** reference 1.16) and provided a fisheries map (**Appendix F**, reference 1.17) and a Consultation Information Sheet.	No feedback received.	No response required.	Woodside has provided sufficient information and opportunity to respond. Woodside considers this adequately addresses stakeholder interests and no further consultation is required.

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5.6 Ongoing Stakeholder Consultation

Woodside is committed to the engagements listed in **Table 5-3**, based on stakeholder feedback.

Table 5-3: Assessment ongoing stakeholder consultation

Stakeholder	Activity
AFMA	Woodside will inform AFMA of future developments.
AHO	Woodside will notify the AHO no less than 4 weeks before operations commence and provide updates to AHO on any changes to planned activities.
AMSA	Woodside will notify AMSA’s JRCC at least 24-48 hours before operations commence, the start and end of operations and provide updates to AMSA on any changes in timing to planned activities.
DAWE	Woodside will inform DAWE of future developments.
DMIRS	Woodside will send DMIRS commencement and cessation notifications.
DNP	Woodside will contact the DNP if details regarding the activity change and result in an overlap with or new impact to a marine park.
	Woodside will contact the DNP if oil/gas pollution incidences occur, or are likely to occur, in a marine park.
DoT	Woodside will consult DoT if there is a spill impacting State water from the proposed activity.
Pilbara Line licence holders	Woodside will send licence holders commencement and cessation notifications.
Pilbara Trap licence holders	Woodside will send licence holders commencement and cessation notifications.
WAFIC	Woodside will inform WAFIC of future developments.
	Woodside will send WAFIC commencement and cessation notifications.

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6. ENVIRONMENTAL IMPACT AND RISK ASSESSMENT, PERFORMANCE OUTCOMES, STANDARD AND MEASUREMENT CRITERIA

6.1 Overview

This section presents the impact and risk analysis and evaluation, EPOs, EPSs and MC for the Petroleum Activities Program, using the methodology described in **Section 2**.

6.2 Analysis and Evaluation

As required by Regulation 13(5) and 13(6) of the Environment Regulations, the analysis and evaluation demonstrate that the identified risks and impacts 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 risks identified during the ENVID (including decision type, current risk level, acceptability of risk and tools used to demonstrate acceptability and ALARP) have been divided into two broad categories:

- planned (routine and non-routine) activities
- unplanned events (accidents, incidents or emergency situations).

Within these categories, impact assessment groupings are based on stressor type, e.g. emissions, physical presence, etc. In all cases, the worst credible consequence was assumed.

The ENVID identified eight impacts and eleven risks associated with the Petroleum Activities Program. Planned activities and unplanned events are summarised in **Table 6-1**.

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

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Table 6-1: Environmental impact analysis summary of planned and unplanned activities

Aspect	EP Section	Risk Rating				Acceptability of Impact/Risk
		Impact/Consequence	Potential Impact/Consequence Level	Likelihood	Current Risk Rating	
Planned Activities (Routine and Non-routine)						
Physical presence: Interference with other users – proximity of MODU and project vessels causing interference with or displacement to third party vessels (commercial fishing and commercial shipping), and temporary continued presence of the wellheads.	**6.6.1**	F	Social and Cultural – Slight, short-term impact (less than one year) to a community or areas/items of cultural significance	-	-	Broadly acceptable
Physical presence: Disturbance to seabed from MODU station keeping, subsea cleaning and preparation for permanent plugging activities, removal of marine habitat growth on Xmas trees and wellheads, and cutting and removal of Xmas trees and wellheads including mud mats for equipment laydown.	**6.6.2**	E	Environment – Slight, short-term impact (less than one year) on species, habitat (but not affecting ecosystems function), physical or biological attributes.	-	-	Broadly acceptable
Routine acoustic emissions: Generation of acoustic signals from DP systems on support vessels, MODU and project vessels during normal operations, generation of atmospheric noise from helicopter transfers within Operational Area and underwater and atmospheric noise from flaring.	**6.6.3**	F	Environment – No lasting effect (less than one month); localised impact not significant to environmental receptors.	-	-	Broadly acceptable
Routine and non-routine discharges: MODU and project vessels.	**6.6.4**	F	Environment – No lasting effect (less than one month); localised impact not significant to environmental receptors.	-	-	Broadly acceptable
Routine and non-routine discharges: cement cuttings, swarf, formation rock, drilling fluids (WBM and NWBM), well clean-out fluids, well kill fluid and wellhead removal fluids (grit and flocculant).	**6.6.5**	F	Environment – No lasting effect (less than one month); localised burial and smothering of benthic habitats and negligible, short-term effects to water quality.	-	-	Broadly acceptable
Routine and non-routine discharges: wet cement, cementing fluids, subsea control fluids, unused bulk products and marine riser clean-out	**6.6.6**	F	Environment – No lasting effect (less than one month); localised impact not significant to environmental receptors.	-	-	Broadly acceptable
Routine atmospheric emissions: Fuel combustion, flaring, incineration and venting	**6.6.7**	F	Environment – No lasting effect (less than one month); localised impact not significant to environmental receptors (e.g. air quality).	-	-	Broadly acceptable
Routine light emissions: External light emissions onboard MODU and project vessels within the Operational Area.	**6.6.8**	F	Environment – No lasting effect (less than one month); localised and temporary disturbance to marine fauna.	-	-	Broadly acceptable
Unplanned Activities (Accidents, Incidents, Emergency Situations)						
Unplanned hydrocarbon release due to loss of well containment	**6.7.2**	B	Environment – Major, long term impact (ten to 50 years) on highly valued ecosystems, species, habitat, physical or biological attributes. Reputation/brand – National concern and/or international interest. Medium to long-term impact (five to 20 years) to reputation and brand. Venture and/or asset operations restricted.	1	M	Acceptable
Unplanned hydrocarbon release from a loss of well containment resulting from accidental damage to, or removal of, Xmas tree during the preservation period or well P&A activities	**6.7.3**	E	Environment – Slight, short-term impact (less than one year) on species, habitat (but not affecting ecosystems function), physical or biological attributes.	1	L	Broadly acceptable
Unplanned hydrocarbon release resulting from a vessel collision	**6.7.4**	D	Environment – Minor, short-term impact (one to two years) on species, habitat (but not affecting ecosystems), physical or biological attributes.	1	M	Broadly acceptable
Unplanned hydrocarbon release during bunkering/refuelling	**6.7.5**	E	Environment – Slight, short-term impact (less than one year) on species, habitat (but not affecting ecosystems function), physical or biological attributes.	2	M	Broadly acceptable
Unplanned discharges: Drilling fluids and well fluids	**6.7.6**	E	Environment – Slight, short-term impact (less than one year) on species, habitat (but not affecting ecosystems function), physical or biological attributes.	2	M	Broadly acceptable

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Aspect	**EP Section**	**Risk Rating**				**Acceptability of Impact/Risk**
		Impact/Consequence	**Potential Impact/Consequence Level**	**Likelihood**	**Current Risk Rating**	
Unplanned discharges: Deck and subsea spills	**6.7.7**	F	Environment – No lasting effect (less than one month); localised impact not significant to environmental receptors (e.g. water quality).	2	L	Broadly acceptable
Unplanned discharges: Release of solid hazardous and non-hazardous wastes	**6.7.8**	F	Environment – No lasting effect (less than one month); localised impact not significant to environmental receptors (e.g. water quality).	2	L	Broadly acceptable
Physical presence: Vessel collision with marine fauna	**6.7.9**	E	Environment – Slight, short term local impact (less than one year) on species, habitat (but not affecting ecosystems function), physical or biological attributes.	1	L	Broadly acceptable
Physical presence: Disturbance to seabed from loss of station keeping	**6.7.10**	E	Environment – Slight, short term local impact (less than one year) on species, habitat (but not affecting ecosystems function), physical or biological attributes.	0	L	Broadly acceptable
Physical presence: Dropped object resulting in seabed disturbance	**6.7.11**	F	Environment – No lasting effect (less than one 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	**6.7.12**	E	Environment – No credible risk identified. Reputation and Brand – Minor, short-term impact (one to two years) to reputation and brand. Close scrutiny of asset level operations or future proposals.	0	L	Broadly acceptable

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6.2.1 Cumulative Impacts

Woodside has assessed the cumulative impacts of the Petroleum Activities Program in relation to other relevant petroleum activities that could realistically result in overlapping temporal and spatial extents. This has resulted in review of the following developments, with impacts discussed as relevant in various sections of **Section 6.6** and **6.7**:

- Wheatstone production – Wheatstone gas pipeline.
- Julimar Operations – JDP2 flowline and umbilical.

Additionally, where relevant the cumulative impacts of activities associated with undertaking multiple concurrent or parallel activities associated with this Petroleum Activities Program have been assessed for cumulative impacts as relevant in **Sections 6.6** and **6.7**.

Given that unplanned activities are not intended to occur during the petroleum activities program, no reasonable estimate of the frequency, intensity or duration of such activities can be made. If these activities are undertaken, they will be discrete events and any impacts will be localised. As such, Woodside has reasonably assessed unplanned events are not credible, with no consideration of cumulative impacts of repeated unplanned events from the Petroleum Activities Program or compounding impacts from other petroleum facilities within the region.

6.3 Environmental Performance Outcomes, Standards and Measurement Criteria

Regulation 13(7) of the Environment Regulations requires that an EP includes EPOs, EPSs and MC that address legislative and other controls to manage the environmental risks and impacts of the activity to ALARP and Acceptable levels.

EPOs, EPSs and MC for the Petroleum Activities Program have been identified to allow Woodside's environmental performance to be measured and through the implementation of this EP, to determine whether the EPOs and EPSs have been met.

The EPOs, EPSs and MC specified are consistent with legislative requirements and Woodside's standards and procedures. They have been developed based on the legislation, codes and standards, good industry practices and professional judgement outlined in **Sections 2.6.1.4** and **2.7**, as part of the acceptability and ALARP justification process.

The EPOs, EPSs and MC are presented throughout this section and in **Appendix D**. A breach of these EPOs or EPSs constitutes a 'Recordable Incident' under the Environment Regulations (refer to **Section 7.8**).

6.4 Presentation

The analysis and evaluation (ALARP and acceptability), EPOs, EPSs and MC are presented in tabular form throughout this section, as shown in the sample below. Italicised text in this example table denotes the purpose of each part of the table, with reference to the relevant sections of the Regulations and/or this EP.

<table>
<tr><th colspan="3">Context
Description of the context for the impact/risk. Regulation 13(1, 13(2) and 13(3)</th></tr>
<tr><td>Description of the Activity – Regulation 13(1)</td><td>Description of the Environment – Regulations 13(2)(3)</td><td>Consultation – Regulation 11A</td></tr>
<tr><th colspan="3">Impacts and Risks Evaluation Summary
Summary of ENVID outcomes</th></tr>
<tr><td>Source of Risk
Regulation 13(1)</td><td>Environmental Value Potentially Impacted
Regulations 13(2)(3)</td><td>Evaluation
Section 2</td></tr>
</table>

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	Soil and Groundwater	Marine Sediment	Water Quality	Air Quality (incl Odour)	Ecosystems/ Habitat	Species	Socioeconomic	Decision Type	Consequence/Impact	Likelihood	Risk Rating	ALARP Tools	Acceptability	Outcome
Summary of source of risk/ impact														

Description of Source of Risk or Impact

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

Impact or Consequence Assessment

Environmental Value/s Potentially Impacted

Discussion and assessment of the potential impacts to the identified environment value/s. Regulation 13(5) (6).

Description of potential impacts to environmental values aligned to Woodside Risk Matrix consequence descriptors.

Demonstration of ALARP

Control Considered	***Control Feasibility (F) and Cost/Sacrifice (CS)***[4]	***Benefit in Impact/Risk Reduction***	***Proportionality***	***Control Adopted***
ALARP/Hierarchy of Control Tools Us–d - Section 2.6.2				
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).*	*Qualitative commentary of impact/risk that could be averted/ environmental benefit gained 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 No. provided.*

ALARP Statement

Made on the basis of the environmental risk/impact assessment outcomes, use of the relevant tools appropriate to the decision type (**Section 2.7**) and a proportionality assessment. Regulation 10A (b).

Demonstration of Acceptability

Acceptability Statement

Made on the basis of applying the process described in **Section 2.7** taking into account internal and external expectations, risk/impact to environmental thresholds and use of environment decision principles. Regulation I(c)

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[4] Qualitative measure

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EPOs, EPSs and MC			
Environmental Performance Outcomes	***Controls***	***Environmental Performance Standards***	***Measurement Criteria***
EPO No. **S**: *Specific performance that 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 through implementation of the controls via the MC.* **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/impact and the potentially impacted environmental value*[5] **T**: *The outcome will state the timeframe during which the outcome will apply or by which it will be achieved.*	**C No.** *Identified control adopted to ensure that the impacts and risks are continuously reduced to ALARP.* *Regulation 13(5) (c).*	**PS No.** *Statement of the performance required of a control measure. Regulation 13(7)(a).*	**MC No.** *Measurement criteria for determining whether the outcomes and standards have been met. Regulation 13(7)(c).*

6.5 Environment Risks/Impacts not Deemed Credible or Outside the Scope of this EP

The ENVID identified a source of environmental risk/impact that was assessed as not being applicable (not credible) within or outside the Operational Area and therefore was determined to not form part of this EP (refer **Section 2.5**). This is described in **Section 6.5.1** for information only.

6.5.1 Shallow/Nearshore Activities

The Petroleum Activities Program is located in water depths greater than 110 m and at a distance about 40 km from the nearest landfall (Montebello Islands). Consequently, risks associated with shallow/near shore activities such as risks of grounding were assessed as not credible.

6.5.2 Risks to the Wheatstone Pipeline and JDP2 Flowline and Umbilical

As described in **Section 4.6.6,** existing subsea infrastructure is present in the Operational Area as part of Chevron's Wheatstone Development and Woodside's Julimar Development (see **Figure 4-14**). The Operational Area for the activity overlaps with the Wheatstone gas pipeline from the Wheatstone offshore facilities to the LNG plant at Ashburton on the mainland. It also overlaps with the JDP2 flowline and umbilical. A subsea loss of containment from a rupture of the Wheatstone pipeline or JDP2 flowline within the Operational Area could occur in the event of a dropped object or if loss of station keeping of the MODU from mooring failure were to result in anchor drag across the pipeline.

Worst-case credible hydrocarbon release scenarios have been defined in the Start-Up and Operations EP for the Wheatstone Project and the Julimar Operations EP, including subsea loss of containment resulting from a rupture of the pipeline/flowline. The EPs provide a description and assessment of impacts and risks. Management controls and response capabilities are also detailed in the EP. Additional controls for operating the MODU are provided throughout **Sections 6.6** and **6.7**

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[5] Where impact/consequence descriptors are capitalised and presented within EPOs in **Section 6**; performance level corresponds with those aligned with the Woodside Risk Matrix (refer **Section 2.6.3**).

of this EP. In particular, controls are included for the prevention of dropped objects (**Section 6.7.11**) and loss of station keeping (**Section 6.7.10**).

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6.6 Planned Activities (Routine and Non-routine)

6.6.1 Physical Presence: Interaction with Other Marine Users

Context		
Project Vessels – **Section 3.8**	Socioeconomic and Cultural – **Section 4.6**	Stakeholder Consultation – **Section 5**

Impact Evaluation Summary

Source of Impact	***Environmental Value Potentially Impacted***							***Evaluation***						
	Soil and Groundwater	Marine Sediment	Water Quality	Air Quality (incl Odour)	Ecosystems/ Habitat	Species	Socioeconomic	Decision Type	Consequence/Impact	Likelihood	Risk Rating	ALARP Tools	Acceptability	Outcome
Interference with other users – proximity of MODU and project vessels causing interference with or displacement to third party vessels (commercial fishing and commercial shipping)							X	A	F	-	-	GP	Broadly acceptable	EPO 1 & 2
Temporary continued presence of the wellheads							X	A	F	-	-			

Description of Source of Impact

Presence of MODU and Vessels

A number of vessels and a MODU (outlined in **Table 3-5**) will be temporarily present in the Operational Area during the Petroleum Activities Program to permanently plug the wells and remove all associated well infrastructure above the seabed.

A subsea support vessel (IMR vessel or AHV) will be used to conduct IMR activities such as removal of marine growth prior to the permanent plugging activity, this will take an estimated one day per well (up to about a week). An AHV may be used to pre-lay the MODU moorings and will take up to three weeks. An IMR may also be required in the Operational Area during the ongoing preservation of the subsea wells prior to removal of the wellheads.

Permanent plugging activities are expected to take about 20 to 60 days per well as outlined in **Section 3.5** and will be undertaken by a semi-submersible moored MODU. An IMR vessel or AHV may be used to cut and recover infrastructure following plugging activities. Recovery of infrastructure will likely take 18 – 36 hours per well and up to about three weeks for all infrastructure, including a seabed clearance survey.

Support vessels will also be present within the Operational Area and may include an AHV (to set anchors and support MODU operations) and activity support vessels such as cargo vessel(s) and barges which will be used for transporting of equipment and materials from a port/staging area to the Operational Area.

The presence of these project vessels and MODU in the Operational Area presents an opportunity for interaction with third-party marine users.

Continued temporary presence of well infrastructure

Following permanent plugging, well infrastructure (above the mudline) may be temporarily left in-situ for up to two and a half years until their removal and/or recovery by a vessel (**Section 3.8**).

Burried mooring anchors

Six mooring anchors will remain embedded below the seabed.

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Impact Assessment

Interactions with Commercial Fishing Activities

The Operational Area overlaps three Commonwealth and 11 State managed fisheries (**Section 4.6.2**). However, only the State-managed Pilbara Line Fishery and Pilbara Trap Managed Fishery are considered to have limited potential for interaction with project activities (**Section 4.6.2**).

The Operational Area is located within a 60 nm CAES block which has reported up to six Pilbara Line Fishery vessels and up to three Pilbara Trap Managed Fishery vessels active in the block each year between 2009 and 2019. Each year consistent annual fishing effort was reported from both fisheries (**Section 4.6.2**). Given the overlap of the Operational Area with the fishing block and the annual fishing effort, interactions with the fishery may occur.

During Project activities, vessels will be temporarily present in the Operational Area and may restrict the use of the area by the fishery, and any other commercial fisheries that have been identified as having potential (but unlikely) to use the Operational Area. Use will particularly be restricted by the 500 m exclusion zone (temporary) that will be established around the MODU and the subsea support vessel when undertaking removal activities. However, because vessels will be in the area for short periods over a defined amount of time, impacts during decommissioning activities will be localised.

Given the short duration of the activity, the temporary presence of project vessels in the Operational Area would potentially result in a localised interference (navigational hazard) and displacement/avoidance by commercial fishing vessels within the immediate vicinity of the MODU or 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.

If a wellhead or Xmas tree is temporarily left in-situ, it is unlikely to displace or cause a risk to other marine users given the water depths where the infrastructure is located and that no trawl fishers currently operate in the area. Although recent fishing effort from the Pilbara Line Fishery overlaps the Operational Area, future interactions with the fishery and infrastructure temporarily left in-situ are not expected given the distribution of effort and the fishing methods utilised by the fishery (i.e. line fishing restricted to the upper portion of the water column). Impacts to commercial fishing activities if any well infrastructure remains in-situ for up to two years before removal are therefore not expected.

Disturbance to marine users are not expected from the six embedded mooring anchors given the anchors will be buried below the seabed.

Displacement of Recreational Fishing

Recreational fishing is unlikely to occur in the Operational Area due to its depth and distance from shore. Stakeholder consultation did not identify any recreational activities that could be impacted by the activity. Recreational fishing in the region is concentrated around the coastal waters and islands of the NWMR, such as the Montebello Islands (about 43 km from the Operational Area).

If recreational fishing effort occurred within the Operational Area while activities are being performed, displacement as a result of the Petroleum Activities Program would be minimal and relate only to the exclusion zones (temporary) (500 m radius) that would be in place around the MODU and the subsea support vessel when undertaking removal activities. Therefore, the potential impact is considered to be localised and would result in no lasting effect.

Displacement to Commercial Shipping

The presence of the MODU and/or project vessels could potentially cause temporary disruption to commercial shipping, however the nearest marine fairway is approximately 37 km north-east of Operational Area. Shipping in the area is mainly related to the resources industry. The potential impacts associated with this Petroleum Activities Program may include displacement of vessels as they make slight course alterations to avoid the MODU and/or subsea support vessel(s).

Interference with Existing Oil and Gas Infrastructure

Interactions with operators of other nearby facilities have the potential to occur, including the Wheatstone gas pipeline (operated by Chevron) and the JDP2 flowline and umbilical, both of which overlap the Operational Area. Although unlikely, interactions may occur with vessels undertaking IMR activities on the Wheatstone gas pipeline and the JDP2 flowline and umbilical. The Pluto Platform (operated by Woodside), Wheatstone Platform (operated by Chevron) and the John Brookes (operated by Santos WA Southwest P/L) are 14 km, 22 km and 39 km from the Operational Area, respectively. This would mainly be as a result of project-based vessel movements to and from the Operational Area, which are not covered within this EP.

There may be cumulative impacts to commercial fisheries from concurrent IMR activities associated with Wheatstone and the JDP2 flowline and umbilical. For the fisheries considered active in the vicinity of the Operational Area, potential cumulative impacts to vessels that overlap the Operational Area would be localised with no lasting effect.

Summary of Potential Impacts to Environmental Value(s)

Given the adopted controls, it is considered that the physical presence of the MODU and project vessels will not result in a potential impact greater than localised displacement of shipping, commercial/recreational fishing, oil and gas interests with no lasting effect.

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Demonstration of ALARP				
Control Considered	***Control Feasibility (F) and Cost/Sacrifice (CS)[6]***	***Benefit/Reduction in Impact***	***Proportionality***	***Control Adopted***
Legislation, Codes and Standards				
No controls identified.				
Good Practice				
AHO notified of activities and movements no less than four working weeks prior to scheduled activity commencement date of permanent plugging and infrastructure removal activities.	F: Yes CS: Minimal cost. Standard practice.	Notification to AHO will enable them to generate navigation warnings (Maritime Safety Information Notifications (MSIN) and Notices to Mariners (NTM) (including AUSCOAST warnings where relevant)).	Control is Standard Practice.	Yes **C 1.1**
Notify relevant fishing industry government departments, representative bodies and licence holders of activities prior to commencement and upon completion of activities.	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 JRCC for the permanent plugging and infrastructure removal activities: • 24-48 hrs before operations commence • when operations start • When operations end	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**
Notify AHO and AMSA JRCC of any extended delay in the timing of the Petroleum Activities Program.	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 1.4**
Notify relevant stakeholders for activities within the Petroleum Activities Program that commence more than a year after EP acceptance.	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	Benefits outweigh cost/sacrifice. Control is also Standard Practice.	Yes **C 1.5**

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1 Qualitative measure

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Demonstration of ALARP				
Control Considered	***Control Feasibility (F) and Cost/Sacrifice (CS)***[6]	***Benefit/Reduction in Impact***	***Proportionality***	***Control Adopted***
		likelihood of interfering with other marine users.		
Establish and maintain a publicly available interactive map which provides stakeholders with updated information on activities being conducted as part of the Petroleum Activities Program including location of MODU.	F: Yes. CS: Minimal cost. Standard practice.	Interactive map provides additional/alternate method for marine users to obtain information on the timing of activities, thereby reducing the likelihood of interference with other marine users.	Benefits outweigh cost/sacrifice.	Yes **C 1.6**
Remove all well infrastructure immediately following permanent plugging activities.	F: Yes. CS: Moderate cost.	Impact assessment has determined leaving well infrastructure on the seabed (either wet parked or connected to the well) for up to two years following permanent plugging activities is not expected to result in impacts to other marine users.	Disproportionate. Cost/sacrifice outweighs benefit to be gained.	No
Remove well infrastructure.	F: Yes. CS: Moderate cost.	Eliminates potential interaction with commercial fishers. No reduction in consequence will occur.	Benefits outweigh cost/sacrifice.	Yes **C 2.1**
Professional Judgement – Eliminate				
No controls identified.				
Professional Judgement – Substitute				
No controls identified.				
Professional Judgement – Engineered Solution				
No 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, **Section 2.6.1**), Woodside considers the adopted controls appropriate to manage the impacts of the presence of the MODU and project vessels during permanent plugging and well infrastructure removal activities.

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, the presence of the MODU and project vessels during permanent plugging and well infrastructure removal activities may result in negligible, localised impacts with no lasting effect (<1 month) to commercial fishing, recreational fishing, shipping and existing oil and gas infrastructure. Due

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Demonstration of ALARP				
Control Considered	***Control Feasibility (F) and Cost/Sacrifice (CS)[6]***	***Benefit/Reduction in Impact***	***Proportionality***	***Control Adopted***
to the size and location of the well infrastructure, the continued presence of well infrastructure for up to 2.5 additional years following permanent plugging activities is not expected to cause impact to other marine users. The adopted controls are considered consistent with industry good practice and professional judgement and meet the requirements and expectations of AMSA and AHO identified during impact assessment and stakeholder consultation. On the basis of the environmental impact assessment outcomes and Woodside's criteria for acceptability outlined in **Section 2.7.2**, this is considered an acceptable level of impact.				

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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 AHO of activities and movements no less than four working weeks prior to the scheduled activity commencement date of permanent plugging and infrastructure removal activities.	**PS 1.1** Notification to AHO of activities and movements to allow generation of navigation warnings (MSIN and NTM [including AUSCOAST warnings where relevant]).	**MC 1.1.1** Consultation records demonstrate that AHO has been notified prior to commencement of permanent plugging and infrastructure removal activities to allow generation of navigation warnings (MSIN and NTM [including AUSCOAST warnings where relevant]).
	C 1.2 Notify relevant government departments, fishing industry representative bodies and licence holders of activities prior to commencement and upon completion of activities.	**PS 1.2** DPIRD, WAFIC, Pilbara Trap licence holders and Pilbara Line licence holders notified prior to commencement and upon completion of activities.	**MC 1.2.1** Consultation records demonstrate that DPIRD has been notified prior to commencement of permanent plugging and infrastructure removal activities.
	C 1.3 Notify AMSA JRCC for the permanent plugging and infrastructure removal activities: • 24-48 hrs before operations commence • When operations start • When operations end	**PS 1.3** Notification to AMSA JRCC to prevent activities interfering with other marine users. AMSA's JRCC will require the MODU's details (including name, callsign and Maritime Mobile Service Identity), 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 within required timeframes.
	C 1.4 Notify AHO and AMSA JRCC of any extended delay in the timing of the Petroleum Activities Program.	**PS 1.4** AHO and AMSA JRCC notified of any extended delay in the timing of the Petroleum Activities Program.	**MC 1.4.1** Consultation records demonstrate that AHO and AMSA JRCC were notified of extended delays in the timing of the Petroleum Activities Program.
	C 1.5 Notify relevant stakeholders for activities within the Petroleum Activities Program that commence more than a year after EP acceptance.	**PS 1.5** Stakeholders will be notified no less than four working weeks prior to scheduled activity commencement date.	**MC 1.5.1** Records demonstrate relevant stakeholders have been consulted.

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	C 1.6 Establish and maintain a publicly available interactive map which provides stakeholders with updated information on activities being conducted as part of the Petroleum Activities Program including location of MODU.	**PS 1.6** Activity interactive map established and maintained throughout activities.	**MC 1.6.1** Records demonstrate interactive map was provided and available to stakeholders throughout activities.
EPO 2 Prevent future adverse interactions with other marine users from well infrastructure.	**C 2.1** Remove well infrastructure.	**PS 2.1** Well infrastructure, above the mudline[7], is removed prior to the end of 2024.	**MC 2.1.1** Seabed clearance survey demonstrates well infrastructure has been removed.

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6.6.2 Physical Presence: Disturbance to Benthic Habitat from MODU Anchoring, Permanent Plugging, Well Infrastructure Removal Activities and ROV Operations

Context		
Mooring installation and anchor hold testing – **Section 3.10.3** Permanent Plugging Activities – **Section 3.10.8.3** Remotely Operated Vehicles – **Section 3.9.1**	Physical Environment – **Section 4.4** Biological Environment – **Section 4.5**	Stakeholder Consultation – **Section 5**

Impact Evaluation Summary														
Source of Impact	***Environmental Value Potentially Impacted***							***Evaluation***						
	Soil and Groundwater	Marine Sediment	Water Quality	Air Quality (incl Odour)	Ecosystems/ Habitat	Species	Socioeconomic	Decision Type	Consequence/Impact	Likelihood	Risk Rating	ALARP Tools	Acceptability	Outcome
Disturbance to seabed from MODU station keeping (MODU mooring, including anchor hold testing).		X	X		X			A	E	-	-	GP	Broadly Acceptable	EPO 3 & 4
Disturbance to seabed from subsea cleaning and preparation for permanent plugging activities (water jetting and sediment relocation), including use of the ROV.		X	X		X			A	F	-	-			
Removal of marine habitat growth on Xmas trees and wellheads.		X	X		X			A	F	-	-			
Disturbance to seabed from cutting and removal of Xmas trees and wellheads including mud mats for equipment laydown.		X	X		X			A	F	-	-			

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Description of Source of Impact

MODU Anchoring and Anchor Hold Testing

Seabed disturbance will result from anchor hold testing and MODU anchor mooring system, including placement of anchors and chain/wire on the seabed, potential dragging during tensioning and recovery of anchors. Overall, mooring of the MODU and anchor hold testing activities will result in localised, small-scale seabed disturbance. Mooring may require an eight to 12 point pre-laid mooring system; however, as permanent plugging activities is planned to take place outside of cyclone season, a standard eight point system is more likely. A single mooring system will be laid and the MODU will kedge between wells.

Moorings will be placed in a radius around the well of up to 4000 m and a mooring analysis will be undertaken to determine the appropriate mooring pattern. 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, 2018a). As part of mooring preparations, anchor holding testing may be conducted and may result in short-term, localised anchor drag on the seabed. The planned anchoring activities will be within the parameters defined in the *Anchoring of Vessels and Floating Facilities EP Reference Case* (Department of Industry, Innovation and Science, undated) during the Petroleum Activities Program, including:

- installation of moorings, buoys, equipment or other infrastructure for a period of up to two years
- wet storage on seabed of anchor chains etc., during activities up to two years
- activities with total areas of seabed disturbance less than 13,000 m²
- locations of water depth greater than 70 m. This boundary is set to exclude areas of sensitive primary producer habitats (e.g. corals, seagrass) that occur in shallower waters.

DTM Anchors Below Seabed

Six DTM mooring anchors (35 Tonne steel Stevpris anchors) are embedded below the seabed and will not be removed. These may corrode and decompose in-situ over time. Steel is mainly comprised of iron (~98%) and also contains small amounts of carbon, manganese, chromium, silicon, and phosphorus.

ROVs

The use of ROVs during the Petroleum Activities Program 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 is limited to that required for effective and safe subsea activities. The footprint of a typical work class ROV is approximately 2.5 m by 1.7 m.

Subsea Cleaning, Sediment Removal and Other Preparation Activities

Subsea cleaning and preparation activities include removing marine growth from infrastructure such as the Xmas trees and relocating sediment that has built up around subsea infrastructure. Removing marine growth may be done in various ways. Those that have the potential to impact the seabed include use of high-pressure water and/or brushes on ROVs.

An ROV may be used to relocate sediment material around the well location to allow inspection/intervention works to be performed. Relocating sediment involves using an ROV-mounted suction pump to remove sediment that has built up around the well infrastructure. This will cause localised and temporary impacts to water quality from increased turbidity and may cause localised and temporary impacts to benthic habitats.

Cutting and removal of Xmas trees and wellheads

Localised seabed disturbance will occur when cutting and removing the Xmas trees and wellheads, including the placement of mud mats for equipment laydown. Given cut is planned to be made from within the well below the mudline, disturbance is expected to be minimal.

Impact Assessment

MODU station keeping (including activities associated with mooring design and anchor hold testing), subsea cleaning and preparation, installation of mud mats and ROV operations are likely to result in localised to short-term, physical modification to the seabed and localised disturbance to soft sediments. The six anchors that will remain embedded below the seabed are expected to have a negligible impact on the surrounding environment.

Benthic habitats within the footprint of the infrastructure laydown consist of soft, unconsolidated sediments which host sparse assemblages of filter- and deposit-feeding epifauna and infauna, as well as demersal fishes. These soft sediment habitats, and associated biological communities, are widely represented throughout the NWMR and are not considered to be of particular conservation significance.

Physical impacts from the Petroleum Activities Program are expected to be for the most part confined to sediment-burrowing infauna associated with the soft sediment seabed and surface epifauna invertebrates, particularly filter feeders, inhabiting the infrastructure. Activities at the wellhead locations may therefore temporarily disturb these

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artificial habitats and associated fauna. These impacts are expected to be localised and mainly restricted to the footprint of the infrastructure and small areas around it. Given the widespread representation of the infauna communities within the Operational Area and the broader NWMR, significant impacts to these communities are not expected. Impacts associated with anchoring and mooring, will occur beyond the footprint of the existing infrastructure, but the area disturbed will also be limited. Impacts to infauna and epifauna associated with hard substrate could occur but would represent a small proportion of the wider representative biota.

The Operational Area overlaps one KEF: the ancient coastline at 125 m depth contour KEF. The ecological values of the KEF are described in **Appendix H**. These include the potential of enhanced productivity associated with sessile communities due to increased availability of nutrients and enhanced vertical mixing of water layers. While the Operational Area overlaps a small portion of the KEF, the ecological functions of the KEF (submerged coastline providing areas of hard substrate, diverse biological assemblages, enhanced productivity) are not predicted to be impacted by the Petroleum Activities Program. Project-specific Mooring Design Analysis will also help avoid any direct physical impacts to natural hard substrate that may occur in the Operational Area. ROV activities near the seafloor and associated sediment relocation activities may result in localised impacts to deep-water biota, 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 very localised, and temporary, and is therefore not expected to have any significant impact to environment receptors, particularly given the low densities of benthic organisms at the water depths of the Operational Area.

The use of water jetting to remove marine growth on the wellhead structures will result in temporary suspension of organic matter and localised increase in turbidity. Water jetting will be limited to what is necessary to perform an effective inspection prior to cutting and removal of the Xmas tree and wellhead.

The cutting and removal of the Xmas trees and wellheads, including the laydown of mud mats will affect a relatively small footprint of the seabed and lead to localised, temporary suspension of sediments. As such, no significant impacts to benthic fauna are expected.

The DTM mooring anchors are buried to 5 m to 5.5 m below the mudline at the tip and between just below mudline and 2 m below the seabed will corrode and decompose over time. Corrosion results in the release of trace amount of metals (e.g. iron and manganese) to the immediate surrounding sediments. Due to the robustness of the materials involved and the depth the anchors are buried in the seabed, corrosion is likely to be a very slow process approximately 0.025 mm/year and 0.06 mm/year (Wang, et al. 2005).

Iron, the main constituent of steel (~98%) is not considered a significant contaminant in the marine environment and is only toxic to marine organisms at extremely high concentrations (Grimwood and Dixon, 1997). As the other constituents represent less than 1% of the steel composition, impacts to marine sediments, highly localised. Given the low toxicity of iron and the slow release rate, impacts to marine sediments are going to be highly localised with no significant impacts.

Based on the above assessment, seabed disturbance and sub seabed impacts are unlikely to impact on the ecological value of the Operational Area and surrounding environment, including the ancient coastline at 125 m depth contour KEF.

Cumulative impacts in relation to other relevant petroleum activities are not predicted to occur as it is expected that any IMR activities associated with the Petroleum Activities Program will be spatially and temporally separated from acitivites associated with the JDP2 and Wheatstone subsea infrastructure. The predicted impacts of these other activities will be similar to those described above, with localised seabed impacts in the vicinity of the subsea infrastructure.

Summary of Potential Impacts to Environmental Value(s)

Given the adopted controls, seabed disturbance from the Petroleum Activities Program will result in no greater than 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)*^{8}	*Benefit/Reduction in Impact*	*Proportionality*	*Control Adopted*
Legislation, Codes and Standards				
Ongoing consultation with DAWE on the application of the Environmental	F: Yes CS: Minimal cost. Standard practice.	Legislative requirement.	Control based on legislative requirements – must be adopted.	Yes **C 3.1**

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1 Qualitative measure

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Demonstration of ALARP				
Control Considered	***Control Feasibility (F) and Cost/Sacrifice (CS)***[8]	***Benefit/Reduction in Impact***	***Proportionality***	***Control Adopted***
Protection (Sea Dumping) Act 1981				
Good Practice				
Project specific mooring design analysis.	F: Yes. CS: Additional costs associated with upgraded MODU mooring design.	The mooring design analysis determines the number and spread of anchors required based on sediment type and seabed topography, reducing the likelihood of anchor drag leading to seabed disturbance.	Benefits outweigh cost/sacrifice.	Yes **C 3.2**
Long baseline (LBL) or ultra-short baseline (USBL) positioning technology used.	F: No. MODU will be moored, therefore, transponder technology is not feasible. CS: Not assessed, control not feasible.	Not assessed, control not feasible.	Not assessed, control not feasible.	No
Environmental monitoring of the seabed prior to and following the Petroleum Activities Program to assess any impacts to seabed.	F: Yes. CS: Significant. Monitoring of the seabed 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 information about the seabed above what is provided by the Woodside Well Location and Site Appraisal Data Sheet and mooring design analysis. 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 adoption of 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
Undertake sediment sampling to understand the potential contaminants of concern and ROV images to understand physical disturbance from the Balnaves	F: Yes. CS: Sediment sampling and ROV costs.	Sediment sampling and analysis an ROV survey will be used to inform future compliance with S270 (3)(e) and (3)(f), at the point of title relinguishment.	Benefits outweigh cost/sacrifice.	Yes **C 4.1**

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Demonstration of ALARP

Control Considered	*Control Feasibility (F) and Cost/Sacrifice (CS)*[8]	*Benefit/Reduction in Impact*	*Proportionality*	*Control Adopted*
Development Project.				
Professional Judgement – Eliminate				
Only use DP MODU (no anchoring required).	F: No. CS: No. It is not feasible to use a DP MODU as the Operational Area is too shallow. Woodside has a demonstrated capacity to manage the environmental risks and impacts from mooring to a level that is ALARP and acceptable.	Not assessed, control not feasible.	Not assessed, control not feasible.	No
Do not use ROV close to, or on, the seabed.	F: No. The use of ROVs (including work close to or occasionally landed on the seabed) is critical, as the ROV is the main tool used to guide and manipulate equipment during plug and abandon activities. ROV usage is already limited to only that required to conduct the work effectively and safely. Due to visibility and operational issues, ROV work on or close to the seabed is avoided unless necessary. CS: Not assessed, control not feasible.	Not assessed, control not feasible.	Not assessed, control not feasible.	No
Unbury and remove DTM anchors from below seabed	See **Section 3.13.2** DTM anchors decommissioning options assessment.			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, **Section 2.6.1**), Woodside considers the adopted controls appropriate to manage the impacts of benthic habitat disturbance from MODU station keeping (including activities associated with mooring design and anchor hold testing), subsea cleaning and preparation, installation of mud mats and ROV operations. As no reasonable additional/alternative controls were identified that would further reduce the impacts without grossly disproportionate sacrifice, the impacts are considered ALARP.

Demonstration of Acceptability

Acceptability Statement

The impact assessment has determined that, given the adopted controls, disturbance to benthic habitats from the Petroleum Activities Program may result in slight and short term effects (<1 year) or lower to habitat (but not affecting

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Demonstration of ALARP				
Control Considered	***Control Feasibility (F) and Cost/Sacrifice (CS)***[8]	***Benefit/Reduction in Impact***	***Proportionality***	***Control Adopted***
ecosystems function), physical and biological attributes of benthic habitats. The adopted controls are considered consistent with industry good practice and professional judgement. On the basis of the environmental impact assessment outcomes and Woodside's criteria for acceptability outlined in **Section 2.7.2**, this is considered an acceptable level of impact.				

Environmental Performance Outcomes, Standards and Measurement Criteria			
Outcomes	***Controls***	***Standards***	***Measurement Criteria***
EPO 3 No impact to benthic habitats greater than a consequence level of E[9] inside the Operational Area during the Petroleum Activities Program.	**C 3.1** Woodside to continue to engage with DAWE on the application of the Environment Protection (Sea Dumping) Act 1981.	**PS 3.1** Woodside continues to engage with DAWE regarding the application of the Environment Protection (Sea Dumping) Act 1981 and to comply with requirements under the Act.	**MC 3.1.1** Stakeholder consultation records demonstrate DAWE continue to be engaged on the application of the Environment Protection (Sea Dumping) Act 1981.
			MC 3.1.2 If required, a sea dumping application will be submitted.
	C 3.2 Project-specific Mooring Design Analysis.	**PS 3.2** Seabed disturbance from MODU mooring limited to that required to ensure adequate MODU station keeping capacity.	**MC 3.2.1** Records demonstrate Mooring Design Analysis completed and implemented during anchor deployment.
EPO 4 Physical damage to the seabed or subsoil and/or potential contaminants of concern are identified for the Balnaves Development Project	**C 4.1** Undertake sediment sampling to understand the potential contaminants of concern and ROV images to understand physical disturbance from the Balnaves Development Project.	**PS 4.1** Implement a sediment sampling program and ROV survey for the Balnaves Development Project.	**MC 4.1.1** Report demonstrates sampling plan implemented and ROV survey undertaken.

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[9] Defined as E - Slight, short term local impact (less than one year), on species, habitat (but not affecting ecosystem function), physical or biological attributes'.

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6.6.3 Routine Acoustic Emissions: Generation of Noise from Project Vessels, MODU, and Helicopter Operations

Context		
Project Vessels – **Section 3.8** Helicopters – **Section 3.9.2** Permanent Plugging Activities – **Section 3.10**	Biological Environment – **Section 4.5**	Stakeholder Consultation – **Section 5**

Impact Evaluation Summary

Source of Impact	*Environmental Value Potentially Impacted*							*Evaluation*						
	Soil and Groundwater	Marine Sediment	Water Quality	Air Quality (incl Odour)	Ecosystems/ Habitat	Species	Socioeconomic	Decision Type	Consequence/Impact	Likelihood	Risk Rating	ALARP Tools	Acceptability	Outcome
Generation of acoustic signals from DP systems on support vessels.						X		A	F	-	-	GP PJ	Broadly acceptable	EPO 5
Generation of acoustic signals from MODU and project vessels during normal operations.						X		A	F	-	-			
Generation of acoustic signals from cutting equipment						X		A	F	-	-			
Generation of atmospheric noise from helicopter transfers within Operational Area.						X		A	F	-	-			
Underwater and atmospheric noise from flaring.						X		A	F	-	-			

Description of Source of Impact

Project vessels and the MODU will generate noise both in the air and underwater, due to the operation of thruster engines, propeller cavitation, plugging operations, on-board machinery etc. These noises will contribute to and have the potential to exceed ambient noise levels which range from around 90 dB re 1 µPa (root square mean sound pressure level (rms SPL)) under very calm, low wind conditions, to 120 dB re 1µPa (rms SPL) under windy conditions (McCauley, 2005).

MODU

Sources of sound from the moored MODU include: 1) machinery and drilling equipment, including pumps, compressor and generators; 2) drilling on the seabed, and the machinery will work at higher power. The sound produced by drilling is continuous and its level is typically quoted as RMS. During drilling, low-frequency tonal components are generated. Frequency spectra contain tonal components up to 600 Hz attributable to diesel-electric generators, with varying frequency depending on electric load (Richardson et al., 1995).

McCauley (1998) recorded source noise levels for moored MODUs a– 149 - 154 dB re 1 µPa at 1 m while actively drilling (with support vessel on anchor) and Greene (1987) recorded source levels of two moored drillships from 145-158 dB re 1 µPa at 1 m during drilling, (with support vessels idling nearby). Accordingly noise from the moored MODU

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are likely to be significantly lower than other sound sources present during P&A activities, such as support vessels on DP.

The MODU may be on location for about 20 to 60 days per well (between 80 and 240 days for all four wells), between May and November. When ongoing, activities will be 24 hours per day, seven days per week.

Project Vessels and Operation of Dynamic Positioning Systems

Subsea support vessels and general support vessels will not anchor within the Operational Area due to water depth; therefore vessels will use DP. Vessels maintain DP for varying durations during the Petroleum Activities Program, depending on the activity being undertaken. A subsea support vessel will be used to conduct removal of marine growth prior to the permanent plugging activity and IMR activities, set anchors and to cut and recover infrastructure following plugging activities. The general support vessel(s) will be transporting equipment and materials from port/staging area to the Operational Area, and for general re-supply and support for the MODU. The main source of noise from a DP vessel relates to using DP thrusters.

Subsea support vessels may use DP while the vessel is maintaining position. McCauley (1998) measured underwater broadband noise equivalent to about 182 dB re 1 µPa at 1 m (RMS SPL) from a support vessel holding station in the Timor Sea; it is expected that similar noise levels will be generated by support vessels used for this Petroleum Activities Program. Hannay et al. (2004) recorded sound measurements from an AHV to be 184.4 dB re 1 µPa at 1 m (rms SPL) while completing anchor pulls. The AHVs that will be used for this activity have not been identified, but it is expected that they will be typical AHVs of a similar size and configuration as the vessel measured by Hannay et al. (2004).

Project vessels and the MODU are conservatively expected to have an overall combined source level of 191 dB re 1 µPa (rms SPL), which represents a doubling of noise output from the single loudest source (i.e. 185 dB + 6 dB).

Cumulative noise from the MODU and/or multiple project vessels operating in the Operational Area may result in slightly elevated noise levels, though this is not expected to significantly increase impacts to marine fauna.

Xmas tree cleaning and preparation will occur up to four months before permanent plug and abandonment and will take about 1 day per well and up to about 1 week for all four wells. Following plugging activities, the IMR vessel or AHV will perform the cut and recovery of infrastructure. This will take 18 – 36 hours per Xmas tree and wellhead; and up to about three weeks for all infrastructure, including a seabed clearance survey.

Cutting of Well Infrastructure

Additional noise from the cutting of the surface casing and conductors is likely to be generated. The casings and conductors will be cut below the mudline to enable wellhead recovery using either abrasive water jet cutting method, or mechanical cutting method.

Helicopter Transfers

Helicopter activities may occur in the Operational Area, including the landing and take-off of helicopters on the MODU or vessel helidecks. Sound emitted from helicopter operations is typically below 500 Hz (Richardson et al., 1995). The peak received level diminishes with increasing helicopter altitude, but the duration of audibility often increases with increasing altitude. Richardson et al. (1995) reports that helicopter sound is audible in air for four minutes before it passed over underwater hydrophones, but detectable underwater for only 38 seconds at 3 m depth and 11 seconds at 18 m depth. Noise levels reported for a Bell 212 helicopter during fly-over was reported at 162 dB re 1 µPa and for Sikorsky-61 is 108 dB re 1 µPa at 305 m (Simmonds et al., 2004).

Flaring

Received levels from airborne propagation modelling were used to ascertain the underwater received levels during flaring activities for the Pyxis EP. Only a very small fraction of the acoustic energy produced from flaring will transmit through the air/water boundary due to the surface of water acting as a reflective plane and a significant component of acoustic energy reflecting back into the air. The angle at which the sound path meets the surface (angle of incidence) influences the transmission of noise energy from the atmosphere through the sea surface; with angles ±>13° from vertical being almost entirely reflected (Richardson et al., 1995). The transmission of sound from air to water was conservatively calculated assuming worst-case vertical incidence. Results indicate the underwater received sound pressure level during flaring is estimated to be 136 dB re 1µPa at 1m below the sea surface. Flaring of annulus gas during plug and abandonment activities will be relatively minor with about 1.55 MMscf of gas potentially flared per well. Accordingly, the potential impacts associated with noise produced during flaring is considered highly localised and not expected to result in any significant impacts to marine fauna.

Impact Assessment

Receptors

The Operational Area is located in waters ~110-160 m deep. The fauna associated with this area will be predominantly pelagic species of fish, with migratory species such as cetaceans, whale sharks and marine turtles

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potentially present in the area seasonally (**Section 4.5.2.5**). Noise interference is a key threat to a number of migratory and threatened cetaceans and marine turtles identified as potentially occurring within Operational Area.

The Operational Area overlaps internesting habitat critical to the survival of flatback turtles and turtles may therefore transit the Operational Area. However, given water depths and distance from shore, the area does not constitute foraging or internesting habitat and occurrence of turtles is expected to be infrequent.

A pygmy blue whale migration BIA is located about 3 km north of the Operational Area (**Section 4.5.2.3**). Pygmy blue whale individuals may occasionally transit Operational Area during April to August and October to January during their seasonal migrations. A humpback whale migration BIA is located about 21 km south and migrating whales may be present between about May and November. Occasional individuals may therefore transit through the Operational Area.

Potential Impact of Noise

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. Hearing loss may be temporary (temporary threshold shift [TTS]; referred to as auditory fatigue), or permanent threshold shift (PTS; 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 (e.g. BIAs). The occurrence and intensity of disturbance is highly variable and depends on a range of factors relating to the animal and situation.

Sound Propagation

Increasing the distance from the noise source results in the level of noise reducing, due primarily to the spreading of the sound energy with distance The way that the noise spreads (geometrical divergence) will depend upon several factors such as water column depth, pressure, temperature gradients, and salinity, as well as surface and bottom conditions.

Cetaceans

The thresholds that could result in a behavioural response, temporary threshold shift (TTS) and permanent threshold shift (PTS) for cetaceans as a result of continuous noise sources are presented in **Table 6-2**. No impulsive noise sources are expected to occur during the activity. These thresholds have been adopted by the United States National Oceanic and Atmospheric Administration (NOAA) (National Marine Fisheries Service [NMFS], 2018). Continuous noise generated by an operating moored MODU are not expected to exceed cetacean PTS or TTS thresholds. Continuous noise generated by a subsea support vessel are not expected to exceed cetacean PTS thresholds, though may exceed the TTS thresholds in proximity to the sound source if exposed for prolonged periods.

It is reasonable to expect that cetaceans 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. Considering proximity of the pygmy blue whale BIA to the Operational Area, it is likely that individuals may transit in and around the Operational Area during migratory periods; however, only transient individuals or small groups are expected. 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 project vessels (including MODU and support vessels, helicopters or flaring) are not considered to be ecologically significant at a population level.

Table 6-2: PTS and TTS onset thresholds of cetaceans for continuous noise

Hearing group and generalised hearing range	PTS onset thresholds (received level)	TTS onset thresholds (received level)	Behavioural response
Low-frequency cetaceans (baleen whales): 7 Hz – 35 kHz	L_E, LF, 24h: 199 dB	L_E, LF, 24h: 179 dB	L_p 120 dB
Mid-frequency cetaceans (dolphins, toothed whales, beaked whales): 150 Hz – 165 kHz	L_E, MF, 24h: 198 dB	L_E, MF, 24h: 178 dB	L_p 120 dB

Source: NMFS (2018)

Marine Turtles

There is a paucity of data regarding responses of marine turtles to underwater noise. A Popper et al. (2014) review assessed thresholds for marine turtles and found qualitative results that TTS was only high for near field exposure, while TTS was low for both intermediate and far field exposure (Popper et al., 2014). McCauley et al. (2000) noted that sea turtles exhibit increased swimming activity at 166 dB re 1 µPa. The thresholds listed in **Table 6-3** are

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considered appropriate for the assessment of impacts from continuous acoustic discharges to marine turtles from the Petroleum Activities Program.

The Recovery Plan for Marine Turtles (Commonwealth of Australia, 2017) notes there is limited information available on the impact of noise on marine turtles and that the impact of noise on turtle stocks may vary depending on whether exposure is short (acute) or long-term (chronic). Turtles have been shown to respond to low frequency sound, with indications that they have the highest hearing sensitivity in the frequency range 100–700 Hz (Bartol and Musick, 2003). No numerical thresholds have been developed for impacts of continuous sources (e.g. vessel noise) on marine turtles. However, given the thresholds outlined in **Table 6-3**, it is reasonable to expect that marine turtles may demonstrate avoidance or attraction behaviour to the noise generated by the Petroleum Activities Program. Potential impacts from predicted noise levels from the project vessels (including MODU and support vessels), helicopters or flaring are not considered to be ecologically significant at a population level.

Table 6-3: Continuous sources – turtle impact threshold for environmental receptors

Receptor	Mortality and potential mortal injury	PTS	TTS	Masking	Behaviour
Sea turtles	(N) Low (I) Low (F) Low	(N) Low (I) Low (F) Low	(N) Moderate (I) Low (F) Low	(N) High (I) High (F) Moderate	(N) High (I) Moderate (F) Low

Note: A range of sound units are provided in the table above, reflecting the range of studies from which this data has been derived. The difference in units presents difficulty in reliably comparing threshold values. Where practicable, the threshold values have been compared with indicative sound sources levels of the same sound unit types to facilitate comparison. The sound units provided in the table above include: relative risk (high, medium and low) is given for fish (all types), turtles and eggs and larvae at three distances from the source defined in relative terms as near (N), intermediate (I) and far (F) (after Popper et al. 2014).

Fish

Fish perceive sound through the ears and the lateral line, which are sensitive to vibration. Some species of teleost or bony fish (e.g. herring) have a structure linking the gas-filled swim bladder and ear, and these species usually have increased hearing sensitivity. These species are considered to be more sensitive to anthropogenic underwater noise sources than species such as cod (*Gadus* sp.), which do not possess a structure linking the swim bladder and inner ear. Fish species that either do not have a swim bladder (e.g. elasmobranchs and scombrid fish (mackerel and tunas)) or have a much-reduced swim bladder (e.g. flat fish) tend to have a relatively low auditory sensitivity. Considering these differences in fish physiology, Popper et al. (2014) developed sound exposure guidelines for fish; these are presented in **Table 6-4** and are considered appropriate to assess continuous acoustic discharges to fish from the Petroleum Activities Program.

Table 6-4: Continuous sources – fish and turtle impact threshold for environmental receptors

Receptor	Mortality and potential mortal injury	PTS	TTS	Masking	Behaviour
Fish: no swim bladder	(N) Low (I) Low (F) Low	(N) Low (I) Low (F) Low	(N) Moderate (I) Low (F) Low	(N) High (I) High (F) Moderate	(N) Moderate (I) Moderate (F) Low
Fish: swim bladder not involved in hearing	(N) Low (I) Low (F) Low	(N) Low (I) Low (F) Low	(N) Moderate (I) Low (F) Low	(N) High (I) High (F) Moderate	(N) Moderate (I) Moderate (F) Low
Fish: swim bladder involving hearing	(N) Low (I) Low (F) Low	170 dB rms SPL for 48 hours	158 dB rms SPL for 12 hours	(N) High (I) High (F) High	(N) High (I) Moderate (F) Low

Note: A range of sound units are provided in the table above, reflecting the range of studies from which this data has been derived. The difference in units presents difficulty in reliably comparing threshold values. Where practicable, the threshold values have been compared with indicative sound sources levels of the same sound unit types to facilitate comparison. The sound units provided in the table above include:

- *Root mean square (rms) sound pressure level (SPL): root mean square of time-series pressure level, useful for quantifying continuous noise sources (as per SEL point above).*
- *Relative risk (high, medium and low) is given for fish (all types), turtles and eggs and larvae at three distances from the source defined in relative terms as near (N), intermediate (I) and far (F) (after Popper et al. 2014).*

Source: Popper et al. (2014)

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Project Vessels and MODU Noise Impacts

As described above, the subsea support vessel and MODU are conservatively expected to have an overall combined source level of 191 dB re 1 µPa (rms SPL). The potential for received levels to exceed weighted thresholds defined for PTS and TTS in marine mammals is considered not credible due to propagation and reduction of sound from the source. The behavioural response threshold for marine mammals is estimated to be exceeded out to several kilometres from the project vessels on DP. The Operational Area is surrounded by open water, with no restrictions (such as shallow waters, embayments) on an animal's ability to avoid the activities.

Considering the proximity of BIAs to the Operational Area, there may be occasional pygmy blue whales and humpback whales within the Operational Area during migratory periods. Interactions between whales and vessels typically results in avoidance behaviour, with whales generally moving away from vessels (Bauer 1986; Stamation et al., 2010). Therefore, potential impacts to pygmy blue whales and humpback whales from predicted noise levels are expected to be limited to behavioural impacts within a localised area around vessels with no lasting effect.

Currently, there are no quantitative sound exposure thresholds for behavioural responses in marine turtles resulting from continuous noise sources. As outlined above, although the Operational Area overlaps with internesting habitat critical to the survival of flatback turtles, marine turtles are not expected to be in the area in high numbers even during nesting and internesting periods (**Section 4.5.2.2**). Therefore, impacts to marine turtles from project vessels or the MODU are expected to be localised with no lasting effect. Other fauna associated with the Operational Area will be predominantly pelagic species of fish, with migratory species such as whale sharks and rays transiting through the Operational Area; these species may be similarly affected by noise from project vessels/MODU.

In summary, potential impacts from vessel noise are likely to be restricted to temporary avoidance behaviour of individuals transiting through the Operational Area with no lasting effect. Individuals foraging or migrating may deviate slightly from their activities or migration route, but are expected to continue on their migration pathway or resume normal behaviours as they move away from the activities.

Cutting of Wellheads

Twachtman et al. (2004) studied the operations and socioeconomic impact of nonexplosive removal of offshore structures, including noise and concluded that mechanical cutting and abrasive water jetting, as well as diamond wire cutting methods, are generally considered harmless to marine life and the environment. Similarly, Pangerc et al. (2016) described the underwater sound measurement data during an underwater diamond wire cutting of a 32” conductor (10 m above seabed in ~80 m depth) and found that the sound radiated from the diamond wire cutting of the conductor was not easily discernible above the background noise at the closest recorder located at 100 m from the source. The sound that could be associated with the diamond wire cutting was primarily detectable above the background noise at the higher acoustic frequencies (above around 5 kHz) (Pangerc et. al., 2016) above the hearing range of low frequency cetaceans. Background noise was attributed to surface vessel activity such as dynamic positioning. In another study, the US Navy measured underwater sound levels when the diamond saw was cutting caissons for replacing piles at an old fuel pier at Naval Base Point Loma (Naval Base Point Loma Naval Facilities Engineering Command Southwest 2017). They reported an average SPL for a single cutter at 136.1-141.4 dB SPL at 10 m, as reported in Fairweather Science (2018).

Any noise propagating at seabed from either abrasive water jet cutting or mechanical cutting of the wellhead casing and conductors is likely to attenuate to levels at, or close to background ambient levels within <100 m of the source, with ambient levels being significantly elevated by the concurrent presence of an IMR vessel on DP or MODU immediately above the wellhead locations. As such, noise from the cutting of the casing and conductors will not add to cumulative noise levels for the operation to any extent.

Airborne Noise Sources – Helicopters and Flaring

Helicopter engines and rotor blades and flaring of annulus gas are a potential source of noise emissions, which may result in behavioural disturbance to marine fauna. Water has a very high acoustic impedance contrast compared to air, and the sea surface is a strong reflector of noise energy (i.e. very little noise energy generated above the sea surface crosses into and propagates below the sea surface (and vice versa) – most is reflected). The angle at which the sound path meets the surface influences the transmission of noise energy from the atmosphere through the sea surface; angles ±>13° from vertical are almost entirely reflected (Richardson et al., 1995). Given this, and the typical characteristics of helicopter flights within the Operational Area (duration, frequency, altitude and air speed), the opportunity for underwater noise levels that may result in behavioural disturbance are considered to be highly unlikely. Note: Helicopter noise during approach, landing and take-off is more likely to propagate through the sea surface due to the reduced air speed and lower altitude. However, helicopter noise during approach, landing and take-off will be mingled with underwater noise generated by the facility hosting the helipad (e.g. thruster noise and machinery noise). Additionally, approach, landing and take-off are relatively short phases of the flight, resulting in little opportunity for underwater noise to be generated.

Given the standard flight profile of a helicopter transfer, maintenance of a more than 500 m horizontal separation from cetaceans (as per EPBC Regulations), and the predominantly seasonal presence of whales within the Operational Area, interactions between helicopters and cetaceans that result in behavioural impacts are considered to be highly unlikely. In the highly unlikely event that cetaceans are disturbed by helicopters, responses are expected to consist of

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short-term behavioural responses, such as increased swimming speed; the consequence of such disturbance is considered to have no lasting effect.

Although unlikely, turtles may be present in low numbers within the Operational Area and may be exposed to helicopter noise when on the sea surface (e.g. when basking or breathing). Typical startle responses occur at relatively short ranges (tens of metres) (Hazel et al., 2007) and, as such, startle responses during typical helicopter flight profiles are considered remote. If a turtle has a behavioural response to the presence of a helicopter, it is expected to exhibit diving behaviour, which has no lasting effect.

The Operational Area may be occasionally visited by migratory and oceanic birds but the area does not contain any emergent land that could be used as roosting or nesting habitat. The closest emergent land is 42 km south-east (Montebello Islands). One seabird BIA, a breeding area for wedge-tailed shearwaters, overlaps the Operational Area (August to April). However, there are no nesting sites such as islands within or near the Operational Area. Several breeding and foraging BIAs for the fairy tern, lesser crested tern and roseate tern occur in the wider EMBA (**Section 4.5.2.4**). Given the expected low density of seabirds within the Operational Area due to a lack of roosting or nesting habitat, the relative infrequency of helicopter flights and lack of lasting effect of potential behavioural responses to helicopter noise, impacts would be unlikely, localised and temporary, and result in no lasting effect.

Flare noise, like helicopter noise, is generated in the atmosphere and has limited potential to propagate in the sea due to the high acoustic impedance of water. Additionally, the height of the flare tower and the unconstrained propagation of noise from the flare in the atmosphere means the potential for impacts to fauna at or near the sea surface is inherently highly unlikely. Receptors above the water, such as birds, may be exposed to noise from the flare. From operational experience birds that rest or roost on offshore infrastructure do not display any discernible behavioural disturbance due to noise from the flare. Therefore, impacts to sensitive receptors from flare noise will have no lasting effect and will be highly localised.

Summary of Potential Impacts to environmental value(s)

It is considered that noise generated by project vessels (including MODU and support vessels), positioning transponders, helicopters or flaring will not result in a potential impact greater than localised impacts, with no lasting effect.

Demonstration of ALARP

Control Considered	***Control Feasibility (F) and Cost/Sacrifice (CS)[10]***	***Benefit/Reduction in Impact***	***Proportionality***	***Control Adopted***
Legislation, Codes and Standards				
No additional controls identified.				
Good Practice				
Flaring restricted to a duration necessary to perform the activity for well bleed-off.	F: Yes. CS: Minimal cost. Standard practice.	Reduces noise emissions to the marine environment.	Benefits outweigh cost/sacrifice.	Yes **C 5.1**
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 Act Regulations.	F: Yes. However, activity support vessel bridge crews already maintain a constant watch during operations in compliance with the Woodside Marine – Charterers Instructions, on the requirements of vessel and whale interactions. In the event of a cetacean (or other sensitive fauna) in close proximity to project vessels, it is unlikely that DP (the most significant source of underwater noise expected during the Petroleum Activities	Given that support 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

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1 Qualitative measure

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Demonstration of ALARP				
Control Considered	***Control Feasibility (F) and Cost/Sacrifice (CS)***[10]	***Benefit/Reduction in Impact***	***Proportionality***	***Control Adopted***
	Program) will be deactivated given it is a safety critical requirement for project vessels to hold station. As such, an MFO implementing management / shut down zones is considered to be ineffective. CS: Additional cost of MFOs			
Undertake site-specific acoustic modelling	F: Yes it is feasible to undertake site-specific modelling; however, the generation of noise from these sources is already well understood and this noise cannot be eliminated due to operating requirements. CS: Additional cost of modelling	Given that noise cannot be eliminated due to operating requirements, modelling would not further reduce the likelihood or consequence of impact, noting that no activities of significant noise generation (i.e. explosives) are proposed.	Disproportionate. The cost/sacrifice outweighs the benefit gained.	No
Professional Judgement – Eliminate				
Remove activity support vessel on standby at the Petroleum Activities Program location.	F: No. Activity support vessel required for safety reasons, particularly for maintaining the 500 m exclusion zone around the MODU or vessel engaged in P&A activities (e.g. LWIV, LCV or IMR vessel). CS: Not considered – control not feasible.	Not considered – control not feasible.	Not considered – control not feasible.	No
Elimination of noise from the project vessels (including MODU and support vessels), positioning transponders, helicopters or flaring.	F: No. The generation of noise from these sources cannot be eliminated due to operating requirements. Note: Operating vessels 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				
Avoid peak migration periods for migratory cetaceans.	F: Yes. Migration periods for cetaceans that may occur in the Operational Area (pygmy blue and humpback whales) are well known. CS: Potentially significant. Woodside has not finalised the schedule for the Petroleum Activities Program, and some	Avoiding migration periods would reduce the likelihood of impacts to cetaceans. However, given that the predicted impacts from noise sources associated with the Petroleum Activities Program are considered to be localised with no	Disproportionate. The cost/sacrifice outweighs the benefit gained.	No

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Demonstration of ALARP				
Control Considered	***Control Feasibility (F) and Cost/Sacrifice (CS)[10]***	***Benefit/Reduction in Impact***	***Proportionality***	***Control Adopted***
	activities may be undertaken on an opportunistic basis and in succession to one another while a vessel is available. Precluding operations during cetacean migration periods may impose a considerable cost and operational burden, while resulting in little environmental benefit.	lasting effect, the overall benefit is minimal.		
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 potential impacts from noise generated from the Petroleum Activities Program to be ALARP. As no reasonable additional/alternative controls were identified that would further reduce the impacts without grossly disproportionate sacrifice, the impacts are considered ALARP.				
Demonstration of Acceptability				
Acceptability Statement The impact assessment has determined that noise disturbance from project vessels, the MODU, helicopters and flaring may result in localised impacts to species with no lasting effect. BIAs within the Operational Area include flatback turtle internesting and wedge-tailed shearwater breeding BIAs. A migration BIA for pygmy blue whales is located 3 km to the north of the Operational Area. Relevant recovery plans and conservation advice have been considered during the impact assessment, and the Petroleum Activities Program is not considered to be inconsistent with the overall recovery objectives and actions of these recovery plans and conservation advice (**Section 6.8**). The adopted controls are considered consistent with industry good practice and professional judgement. On the basis of the environmental impact assessment outcomes and Woodside's criteria for acceptability outlined in **Section 2.7.2**, this is considered an acceptable level of impact.				

Environmental Performance Outcomes, Standards and Measurement Criteria			
Outcomes	***Controls***	***Standards***	***Measurement Criteria***
EPO 5 Minimise impacts to marine fauna from noise emissions.	**C 5.1** Flaring restricted to a duration necessary to perform the activity for well bleed-off.	**PS 5.1** Flaring restricted to a duration necessary to perform the activity for well bleed-off.	**MC 5.1.1** Records demonstrate flaring was restricted to a duration necessary to perform the activity for well bleed-off.

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6.6.4 Routine and Non-routine Discharges: MODU and Project Vessels

Context		
Project Vessels– **Section 3.8** Permanent Plugging Activities – **Section 3.10**	Physical Environment – **Section 4.4** Biological Environment – **Section 4.5**	Stakeholder Consultation – **Section 5**

Impact Evaluation Summary

Source of Impact	***Environmental Value Potentially Impacted***							***Evaluation***						
	Soil and Groundwater	Marine Sediment	Water Quality	Air Quality (incl Odour)	Ecosystems/ Habitat	Species	Socioeconomic	Decision Type	Consequence/Impact	Likelihood	Risk Rating	ALARP Tools	Acceptability	Outcome
Routine discharge of sewage, grey water and putrescible wastes to marine environment from MODU and project vessels			X					A	F	-	-	LCS	Broadly Acceptable	EPO 6
Routine discharge of deck and bilge water to marine environment from MODU and project vessels			X					A	F	-	-			
Routine discharge of cooling water or brine to the marine environment from MODU and project vessels			X					A	F	-	-			

Description of Source of Impact

The MODU and project vessels routinely generate/discharge:

- Small volumes of treated sewage, putrescible wastes and grey water to the marine environment (impact assessment based on approximate discharge of 15 m^3 per vessel/MODU per day), using an average volume of 75 L/person/day and a maximum of 200 persons on board. However, it is noted that vessels such as support vessels will have considerably less persons on board.
- Routine/periodic discharge of relatively small volumes of bilge water. Bilge tanks receive fluids from many parts of the project vessels or MODU. Bilge water can contain water, oil, detergents, solvents, chemicals, particles and other liquids, solids or chemicals.
- Variable water discharge from MODU/vessel decks directly overboard or via deck drainage systems. 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 onboard project vessels and MODU.

Environmental risks relating to the unplanned disposal/discharges are addressed in **Section 6.7.6** and **6.7.7.**

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Impact Assessment

The principal 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 coliform, volatile and semi-volatile organic compounds, phenol, hydrogen sulphide, metals, surfactants and phthalates.

Woodside conducted monitoring of sewage discharges at its Torosa-4 Appraisal Drilling campaign which demonstrated that a 10 m^3 sewage discharge reduced to about 1% of its original concentration within 50 m of the discharge location. In addition to this, monitoring at distances 50 m, 100 m and 200 m downstream of the platform and at five different water depths confirmed that discharges were rapidly diluted; no elevations in water quality monitoring parameters (e.g. total nitrogen, total phosphorous and selected metals) were recorded above background levels at any station (Woodside, 2011). Mixing and dispersion would be further 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 and 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 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 and Johnston, 1975). Plankton communities are expected to rapidly recover from any such short-term, 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 and cooling water), will be rapidly diluted through the same mechanisms as above. They are expected to be intermittent and 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 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) 2013.

Activities associated with the Petroleum Activities Program will occur over a period of three years (2022-2024), however actual project activities are expected to take approximately 280 days in total, therefore project vessels and the MODU will not be continuously in the Operational Area during this time. Vessels will also be moving (i.e. not in a single location for an extended period of time). Rather, these routine discharges are expected to be intermittent in nature for the duration of the Petroleum Activities Program. Therefore, cumulative impacts to water quality within the Operational Area are expected to be localised with no lasting effect.

It is possible that marine fauna transiting the localised area may come into contact with these discharges (e.g. marine turtles, humpback whales, whale sharks, as they traverse the Operational Area, **Section 4.5.2**). However, given the localised extent of cumulative impacts from multiple vessel discharges within the Operational Area, significant impacts to marine fauna are not expected.

Summary of Potential Impacts to Environmental Value(s)

Given the adopted controls, it is considered that 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)***[11]	***Benefit/Reduction in Impact***	***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 are passed through a macerator so that 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 6.1**
Marine Order 96 – Marine pollution prevention – sewage (as appropriate to vessel class) which includes the following requirements: • a valid International Sewage Pollution Prevention (ISPP) Certificate, as required by vessel class • a sewage treatment plant approved by AMSA or an issuing body • a sewage comminution and disinfection 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 (more than four 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 6.2**

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1 Qualitative measure

Where there is potential for loss of primary containment of oil and chemicals on the MODU, deck drainage must be collected via a closed drainage system, e.g. drill floor.	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 6.3**
Marine Order 91 – Marine pollution prevention – oil (as relevant to vessel class) requirements, which includes mandatory measures for processing oily water before discharge: • Machinery space bilge/oily water shall have International Maritime Organisation (IMO)-approved oil filtering equipment (oil/water separator) with an online monitoring device to measure OIW content to be less than 15 ppm before 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 less than 15 ppm without dilution or be treated by an IMO-approved oil/water separator, they will be contained on-board and disposed of onshore. • Valid International Oil Pollution Prevention (IOPP) Certificate.	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 6.4**
Good Practice				
No additional controls identified.				
Professional Judgement – Eliminate				
No additional controls identified.				

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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 the implementation of 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, **Section 2.6.1**), Woodside considers the adopted controls appropriate to manage the impacts of planned routine discharges from the MODU and project vessels. As no reasonable additional/alternative controls were identified that would further reduce the impacts without grossly disproportionate sacrifice, the impacts are considered ALARP.				
Demonstration of Acceptability				
Acceptability Statement The impact assessment has determined that, given the adopted controls, routine and non-routine discharges from the MODU and project vessels may result in localised impacts with no lasting effect (<1 month) to water quality and species. BIAs within the Operational Area include flatback turtle internesting, whale shark foraging, and wedge-tailed shearwater breeding BIA. However, these species are not expected to be impacted. The adopted controls are considered consistent with industry legislation, codes and standards, and professional judgement and meet the requirements of Australian Marine Orders. On the basis of the environmental impact assessment outcomes and Woodside's criteria for acceptability outlined in **Section 2.7.2**, this is considered an acceptable level of impact.				

Environmental Performance Outcomes, Standards and Measurement Criteria			
Outcomes	***Controls***	***Standards***	***Measurement Criteria***
EPO 6 No impact to water quality greater than a consequence level of F[12] from discharge of sewage, greywater, putrescible wastes, bilge and deck drainage to the marine environment during the Petroleum Activities Program.	**C 6.1** Marine Order 95 – Marine pollution prevention – garbage (as appropriate to vessel class) which requires putrescible waste and food scraps be passed through a macerator, so they are able to pass through a screen with no opening wider than 25 mm.	**PS 6.1** MODU and project vessels compliant with Marine Order 95 – Marine pollution prevention – garbage.	**MC 6.1.1** Records demonstrate MODU and project vessels are compliant with Marine Order 95.
	C 6.2 Marine Order 96 – Marine pollution prevention – sewage (as appropriate to vessel class) which	**PS 6.2** MODU and project vessels compliant with Marine Order 96 – Marine pollution prevention – sewage (as	**MC 6.2.1** Records demonstrate MODU and project vessels

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[12] Defined as 'F - No lasting effect (less than one month). Localised impact not significant to areas or items of cultural significance)'.

	includes the following requirements: - a valid ISPP Certificate, as required by vessel class - a sewage treatment plant approved by AMSA or an issuing body - a sewage comminution and disinfection 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 (more than four knots), to avoid discharges in environmentally sensitive areas.	appropriate to vessel class).	are compliant with Marine Order 96.
	C 6.3 Where there is potential for loss of primary containment of oil and chemicals on the MODU, deck drainage must be collected via a closed drainage system, e.g. drill floor.	**PS 6.3** Contaminated drainage contained, treated and/or separated before discharge.	**MC 6.3.1** Records demonstrate MODU has a functioning bilge/oily water management system.
	C 6.4 Marine Order 91 – Marine pollution prevention – oil (as relevant to vessel class) requirements, which includes mandatory measures for processing	**PS 6.4** Discharge of machinery space bilge/oily water meet oil content standard of less than 15 ppm without dilution.	**MC 6.4.1** Records demonstrate discharge specification met for MODU and project vessels.

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	oily water before discharge: • Machinery space bilge/oily water shall have IMO-approved oil filtering equipment (oil/water separator) with an online monitoring device to measure OIW content to be less than 15 ppm before 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 less than 15 ppm without dilution or be treated by an IMO-approved oil/water separator, they will be contained on-board and disposed of onshore. • Valid IOPP Certificate.		

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6.6.5 Routine and Non-routine Discharges: Well Clean-out Fluids, Well Kill Fluid, Cement Cuttings, Swarf, Formation Rock, Drilling Fluids (WBM and NWBM), and Wellhead Removal Fluids (Grit and Flocculant)

Context		
Permanent plugging activities – **Section 3.10** Additional potential MODU/ based activities – **Section 3.12** Removal and recovery of infrastructure – **Section 3.13** Project fluids – **Section 3.15**	Physical Environment – **Section 4.4** Biological Environment – **Section 4.5**	Stakeholder Consultation – **Section 5**

Impact Evaluation Summary

Source of Impact	**_Environmental Value Potentially Impacted_**							**_Evaluation_**						
	Soil and Groundwater	Marine Sediment	Water Quality	Air Quality (incl Odour)	Ecosystems/ Habitat	Species	Socioeconomic	Decision Type	Consequence/Impact	Likelihood	Risk Rating	ALARP Tools	Acceptability	Outcome
Non-routine discharge of well kill fluids and well clean out fluids to the marine environment		X	X		X			A	F	-	-	GP PJ	Broadly Acceptable	EPO 7
Non-routine discharge of WBM, NWBM, swarf, cement cuttings and formation rock cuttings to the marine environment during milling		X	X		X			A	F	-	-			
Non-routine discharge of WBM and cement cuttings to the marine environment during drilling out of a cement plug		X	X		X			A	F	-	-			
Non-routine discharge of grit and flocculant during removal of well infrastructure		X	X		X			A	F	-	-			

Description of Source of Impact

Permanent Plugging Program and Removal of Well Infrastructure

The base case for permanently plugging the wells includes the use of well kill fluid, well clean out fluid and wet cement and will produce well annulus fluids (NWBM, lift gas (see **Section 6.6.7** on atmospheric emissions), residual hydrocarbons and residual produced formation water). These fluids will be generated during the well kill, well bore clean out, circulation of the annulus and washing out of the mud pit.

A potential additional activity that may be required as part of the Petroleum Activities Program includes milling, which will produce metal swarf, drilled cement cuttings and formation rock. While this additional activity is planned to use WBM, it may require using small volumes of NWBM. Another potential additonal activity is drilling, with WBM, out a cement plug if it does not pass the verification test, resulting in cement cuttings.

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All of the downhole plugging for permanent abandonment activities are conducted through the marine riser. This includes displacing the well from one fluid system to another. The marine riser is a closed system, meaning there are no planned discharges directly to sea during these activities. Planned discharges of the above fluids are only planned to occur after they have been received on the MODU.

The following describes the source of impact with respect to discharge of cement cuttings, drilling fluids, clean-up fluids, well kill fluids, grit and flocculant only (see **Section 6.6.6** for cement, cementing fluids and subsea control fluids). For the purposes of this impact assessment, the indicative dimensions, discharge locations and approximate volumes are provided in **Table 6-5.**

Table 6-5: Estimated discharges of planned solids and volumes of drilling fluids used per well for the Petroleum Activities Program*

Description	Discharge Point	Discharge	Approximate Cuttings Discharged (m^3)*	Approximate Fluid Discharged (m^3)*	Potential Additional cuttings (m^3)*	Potential Additional Fluid Discharge (m^3)*
Discharge from bleed off package	Below the sea surface	Well kill and well bore fluids	0	155^,**	0	0
Discharge from mud system operations	Below the sea surface	B-annulus NWBM	0	0**	0	0
Discharge from mud system operations	Below the sea surface	WBM$^{\#}$	0	0	0	635
Milling (potential activity using WBM)	Below the sea surface	WBM, swarf, cement and formation rock	0	0	2 (swarf) 3 (cement) 3.5 (formation rock)	1600 (WBM)
Milling (potential activity using NWBM)	Below the sea surface	NWBM, swarf, cement and formation rock	0	0	2 (swarf) 3 (cement) 3.5 (formation rock)	5 (NWBM)
Drilling out cement plug (potential additional activity using WBM)	Below the sea surface	WBM, cement cuttings	0	0	25 (cement cuttings)	250 (WBM)
Abrasive water jet cutting to remove wellheads (removal option)	Within the well below the mudline	Flocculant and grit	4 tonnes per well (planned to be released within the well above the top permanent plug with small volumes entering sediments at the cutting depth)	250 L per well (planned to be released within the well above the top permanent plug with small volumes entering sediments at the cutting depth)	Small volumes may be released to surface sediments if cut is made at or close to the mudline.	
Mechanical cutting of wellheads	Within the well, 3-5 m	Metal and cement cuttings from the well	0	0	Negligible volumes may be released to surface sediments	

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(removal option)	below the mudline	infrastructure and lubrication for the cutting tool			if cut is made at or close to the mudline.

^Represents maximum current in-well reservoir fluid. This will only be discharged if <30 ppm OIW can be achieved.

*Volumes described are approximate and may be subject to change due to well design and operational requirements

**Seawater or brine volume not included in the estimated "fluid volume"

$^{\#}$ Viscosified brine is planned on being used for B-annulus NWBM removal, however, WBM may be used for efficient clean out.

Wellbore, Well Kill and Circulation Fluids

During permanent plugging activities, wells will generally be displaced from one fluid to another. During such operations, fluids will be returned to the MODU via bleeding off fluids from the well or by circulated through the well during various operations (e.g. well kill, well-bore clean-out, NWBM removal, milling operations). Depending on the operation, returned fluids may include reservoir fluids, annulus fluids, brine, WBM, NWBM or solids. This includes a number of chemicals that are already present in the well from either the time of drilling, well intervention or injected during operations. The majority of chemicals that may be present are low toxicity and biodegradable, with the exception of NWBM.

During these operations, two separate systems are in place for managing returns from the wellbore, where the routing to either of the two systems is dictated by the operation and well status.

Fluids Returned to the Fluid Handling Bleed-off Package

During well kill operations, the aim is to bullhead tubing contents into the formation. Fluids remaining in the well after bullheading (e.g. remaining annulus fluids, tubing fluids where bullheading was not successful) will be bled off or circulated out of the well to the MODU and routed to the bleed-off package. All well kill fluids (contaminated brine) and produced water either condensed or formation water returned to the bleed-off package, shall be treated via the water filtration package to less than 30 ppm oil in water content and discharged overboard.

The bleed-off package is designed to handle fluids and cannot handle solids. It will be used for well kill operation only where the well status allows line-up to the bleed-off package.

Fluids and solids returned to the mud system

Where fluids are circulated from the well and the bleed-off package cannot be used, the MODU's mud system will be used to take any returns from the well. This mud system contains mud pits (tanks) which can contain and handle WBM, NWBM, and brine. Fluids required for the permanent plugging activities is planned to be inhibited and/or viscosified brine, but may include WBM and/or NWBM for contingency activities such as milling or drilling out a cement plug (see **Table 6-5**). In this instance, returns from the well handled by the mud system may be re-circulated or re-used if feasible. To re-use the fluids, solids are removed using solids control equipment (SCE). The solids handling and discharges are described below. The WBM fluids, where re-use is not feasible, will be discharged to sea. Discharge of NWBM may occur where the oil content is less than 1% by volume.

The mud system will be used for circulating out NWBM from the B-annulus. Fluids circulated from the well to the MODU containing greater than 1% NWBM (up to 160 m^3 per well) will be retained and disposed of onshore, or injected into the well and isolated from the environment.

At the completion of permanent plugging activities, the mud pits will be cleaned out, typically using seawater. The mud pit wash residue, including residual NWBM where a mud pit was used to collect B-annulus fluids, will be discharged to the sea when the oil content is less than 1% by volume. Where the mud pit residue exceeds 1% oil content by volume, the residue will be retained and disposed onshore.

Base oil and chemicals used in WBM and NWBM are assessed in accordance with the Woodside Chemical Selection and Assessment Environment Guideline. As the NWBM from the B-annulus are currently in the well they will not require further chemical assessment however the discharge of the residual NWBM from mud pit wash out has been considered in the impact assessment below.

Milling

During permanent plugging activities, there is a potential additional activity where the well casing needs to be milled out (up to 100 m per well). This will produce milled swarf (2 m^3 per well), drilled cement cuttings (3 m^3 per well) and formation rock (3.5 m^3 per well) and will preferentially be completed using WBM. There may be instances where NWBM is required for operational purposes to manage well stability to safe levels. The solids from the WBM or NWBM drilling fluid system (including the swarf, drilled cement cuttings and formation rock) will also pass through the shakers, to separate these solids before discharging them. Given the small volumes of solids and only limited drilling into formation rock, no oil on cuttings (OOC) discharge limits have been applied, as would be the case for a drilling activity. The estimated volume of solids discharged with residual NWBM on them is expected to be about 5 m^3 (per 100 m milled interval).

Cement plug drilling

During permanent plugging activities, there is a potential additional activity where a permanent abandonment plug needs to be drilled out if positive verification cannot be obtained. Up to about 25 m^3 of cement cuttings and about

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250 m^3 of WBM will be processed through the MODU's shakers and mud system before being discharged. Given the small volumes and the fact the drilling would be performed with WBM, no oil on cuttings (OOC) discharge limits have been applied.

Removal (Cutting) of Well Infrastructure

As the planned cutting depth is approximately 3-5 m below the mudline, discharges from cutting of well infrastructure using either an abrasive water jet cutting method of a mechanical cutting tool are expected to be confined predominately within the well and settle on the top of the permanent plug. During final cut through the conductor pipe, small amounts of flocculant and grit will be released below the mudline to sediments immediately surrounding the well.

Should cutting at a shallower depth be required, however, these discharges may be released to the seabed surface. For the mechanical cutting tool, discharges will be limited to small quantities of metal and cement cuttings from the infrastructure itself as well as small quantities of lubricant. For the abrasive water jet cutting method, discharges include a small amount of grit and flocculant. Depending on the cutting depth, pressure from the jet cutting could push some of the material up to the seabed surface causing localised smothering of benthic communities as well as create localised and temporary increases in turbidity around the well.

See **Section 6.6.6** for description and assessment of other potential discharges from plugging and infrastructure removal and recovery.

Impact Assessment

The identified potential impacts associated with discharging WBM, potential NWBM and brine (collectively referred to as drilling fluids), as well as metal and cement cuttings and grit and flocculant from infrastructure removal include a localised and temporary reduction in water and localised change in seabed sediment quality, as well as localised burial of benthic biota (species) and change to habitats and communities.

A number of direct and indirect impact pathways are identified for these discharges, including:

- temporary increase in total suspended solids (TSS) in the water column
- attenuation of light penetration as an indirect consequence of the elevation of TSS and the rate of sedimentation
- sediment deposition to the seabed, leading to the alteration of the physico-chemical composition of sediments, and burial and potential smothering effects to sessile benthic biota
- potential contamination and toxicity effects to benthic and in-water biota.

The Operational Area is situated in offshore waters (about 50 km from the nearest shoreline of the Montebello Islands) in water depths of ~110 to 160 m. The abiotic habitat in the area is likely comprised of deep, soft, unconsolidated sediment, which is relatively flat and featureless. However, the Ancient Coastline at 125 m Depth Contour KEF overlaps the Operational Area; therefore, there may be areas of hard substrate associated with this KEF.

The permanent plugging activities occur with a riser fitted, creating a closed loop system. Small volumes of cement cuttings and/or formation cuttings with unrecoverable fluids are brought to the surface via the riser and discharged below the water line from the MODU, resulting in drilled cement and drilling fluids (WBMs, brine and/or NWBMs) rapidly diluting and dispersing through the water column. The dispersion and fate of the solids are determined by particle size and density of the unrecoverable fluids; the larger solid particles will drop out of suspension and deposit in proximity to the well site (tens of metres) with potential for localised spreading downstream, while the fluids and finer particles will remain in suspension and will be transported away from the well site, rapidly diluting and eventually depositing over a larger area (hundreds of metres) downstream of the well site. Elevated TSS will occur and will be highest at the point of discharge in the water column, rapidly decreasing with depth and distance over a period of short duration (minutes). The finer particles (associated with the drilling fluids) will remain in suspension and are transported further before settling on the seabed over a wider area (hundreds of metres) downstream of the well site (defined as an area of influence). They will form an undetectable thin sediment veneer with negligible ecological impact to benthic biota. Within the area of influence, drilling fluids are likely to be naturally reworked into surface sediment layers through bioturbation (US Environmental Protection Agency, 2000).

WBM cuttings discharged from the surface (though below the waterline) are generally confined to a maximum of 500 m from the discharge point (IOGP, 2016). NWBM cuttings discharges to water less than about 300 to 400 m in depth typically deposits in sediments within about 100 to 200 m of the discharge point (IOGP, 2016). For the Petroleum Activities Program, because the volumes of cement cuttings are so low, and formation cuttings are only associated with contingency plug and abandonment activities and would also be in low volumes, the extent of the environment impacted is expected to be significantly lower than what is stated in the literature, which is based on drilling new wells with higher volumes of solids.

If removal of infrastructure results in discharges to the seabed then this will result in localised disturbance to the sediments and communities immediately surrounding the well infrastructure and potentially localised temporary increases in turbidity, with no toxicological effects.

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Habitats and Communities (physical impact of cement cuttings and formation cuttings)

Ecological impacts to sessile benthic organisms is predicted when sediment deposition is equal to or greater than 6.5 mm (in thickness) (IOGP, 2016). Given the volumes of discharges expected and that they will be released from the MODU, this is not expected to occur.

No hard coral habitat or other light-dependent benthic primary producer communities are expected to be present within the Operational Area, with the closest coral reef at the Montebello Islands (42 km away). However, the presence of the Ancient Coastline at the 125 m Depth Contour KEF and the fauna associated with the subsea infrastructure does present the possibility of the presence of hard substrate within the Operational Area and associated encrusting assemblages, such as soft corals and sponges. The KEF is widely represented outside the Operational Area and the discharges is expected to be in small volumes, therefore the potential ecological impacts will be localised and would have negligible impact on the whole KEF.

Water Quality

As outlined above, increased turbidity and TSS levels in the water column will be temporary and highly localised at the point of discharge. Nelson et al. (2016) identified less than 10 mg/L TSS has no effect or sub lethal minimal effect concentration. Given the generally low concentration of TSS (due to rapid dispersion from the MODU, the offshore open ocean site in conjunction with rapid dispersion of sediment, the small volumes of discharge and the short period of intermittent discharge impacts to water quality are expected to be negligible with no impacts to any protected species.

Sediment Quality and Habitats and Communities (contamination from and toxicological effects of drilling muds)

Indicative components of the WBM system outlined in **Section 3.15.2** have a low toxicity. Bentonite and a chemical from the family of XC polymers (Xanthan Gum or similar) are listed as ‘E’ category fluids under the OCNS and are included on the OSPAR list of chemicals used and discharged offshore that are considered to ‘pose little or no risk to the environment’ (PLONOR). These metals are present primarily as insoluble mineralised salts. Consequently, they are not released in significant amounts to the pore water of marine sediments and have low bioavailability to those benthic fauna that may come into contact with the discharged barite (Crecelius et al., 2007; Neff, 2008).

The XC polymer and bentonite sweeps have very low toxicities and are included on the PLONOR list. They may, however, cause physical damage to benthic organisms by abrasion or clogging, or through changes in sediment texture that can inhibit the settlement of planktonic polychaete and mollusc larvae (Swan et al., 1994). However, these impacts are expected to be negligible, due to the low volumes that will be discharged and rapid biodegradation and dispersion of WBM drilling fluids (Terrens et al., 1998). The dilution of solid elements of the WBM into substrate largely depends on the energy level of the local environment and the ‘mixing’ that occurs, but is expected to occur rapidly after release (especially with WBM).

Base fluids for NWBM (which may be used if needed for milling activities, and will be recovered from the wells during B-annulus NWBM remediation activities) are designed to be low toxicity and biodegradable in offshore marine sediments. Biodegradation can result in a low oxygen (anoxic) environment, resulting in changes in benthic community structure. However, given the small volumes that may be discharged, impacts to benthic habitats and communities will be negligible.

One chemical within the B-annulus NWBM was identified as non-biodegradeable however it would only be discharged to the marine environment as residual contamination in the mud pit wash and due to the neglible volume it is expected to rapidly dilute within the vicinity of the release location wit no lasting effect.

Fluids released during Xmas tree and wellhead removal

After permanent plugging and B-annulus NWBM removal is complete, the Xmas tree and wellheads will be cut and recovered. Upon removal, the remaining water-based casing and annulus fluids become exposed to the sea. The small volumes and non-instantaneous nature of the release of the well fluids is expected to result in rapid dilution to a no-effect concentration within metres of the release location. Therefore, impacts will be limited to negligible.

Cumulative Impacts

No cumulative impacts to water quality are expected to occur, as discharged sediments are predicted to settle in between the plug and abandon activities for each well.

Summary of Potential Impacts to Environmental Value(s)

Given the adopted controls, it is considered that the discharges of drilling fluids, well clean-out fluids, cement cuttings, formation rock and swarf described will not result in a potential impact greater than localised burial and smothering of benthic habitats and negligible, localised effects to water quality (e.g. turbidity increase) (i.e. Environment Impact – F). Any localised impacts to water quality and marine fish are not expected to impact on any commercial fishers in the area.

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Demonstration of ALARP				
Control Considered	***Control Feasibility (F) and Cost/Sacrifice (CS)[13]***	***Benefit/Reduction in Impact***	***Proportionality***	***Control Adopted***
Legislation, Codes and Standards				
No additional controls identified.				
Good Practice				
Fluids, flocculant and additives to be used and intended or likely to be discharged to the marine environment will have an environmental assessment completed before use.	F: Yes. CS: Minimal cost. Standard practice.	Environmental assessment of chemicals will reduce the consequence of impacts resulting from discharges to the marine environment by ensuring chemicals have been assessed for environmental acceptability. Planned discharges are required for the safe execution of activities and therefore no reduction in likelihood can occur.	Benefits outweigh cost/sacrifice.	Yes **C 7.1**
Chemical reviews will be performed on all previously approved chemicals to confirm potential chemical impacts are reduced to ALARP.	F: Yes. CS: Minimal cost. Standard practice.	Reviews will ensure chemicals selected for drilling and completions fluids remain ALARP.	Benefits outweigh cost/sacrifice.	Yes **C 7.2**
Written justification process followed prior to use of NWBM.	F: Yes. CS: Minimal cost. Standard practice.	The written justification considers the technical need for NWBM use, receiving environment, cost and additional controls that may be required. By performing formal assessment, the potential impacts are well understood, allowing for development of control measures to reduce the consequence of NWBM use. This provides an overall environmental benefit.	Benefits outweigh cost/sacrifice.	Yes **C 7.3**
Fluids circulated from the well to the MODU containing greater than 1% NWBM (up to 160 m^3 per well) will be retained and disposed of onshore, or injected into the well and isolated from the environment.	F: Yes. CS: Minimal cost. Standard practice.	By taking the fluid with >1% NWBM onshore or reinjecting it into the well and disolating it from the marine environment the consequence of the release on the environment is eliminated. The decrease in	Benefits outweigh cost/sacrifice.	Yes **C 7.4**

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1 Qualitative measure

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		consequence results in an environmental benefit.		
Bulk operational discharges conducted under MODU's PTW system (to operate discharge valves/pumps).	F: Yes. CS: Minimal cost. Standard practice.	The MODU's PTW may slightly reduce the likelihood of bulk discharges occurring, but it is unlikely to be significant given bulk discharges are often operationally required and cannot be eliminated.	Benefits outweigh cost/sacrifice.	Yes **C 7.5**
Brine, WBM and clean-up fluids routed via the MODU mud system which are contaminated with base oil or NWBM, will be captured on the MODU for discharge if oil concentration is less than 1% by volume, or if discharge requirements cannot be met either returned to shore or injected into the well and isolated from the environment.	F: Yes. CS: Minimal cost. Standard practice.	Ensuring <1% oil content will provide a small reduction in consequence when fluids are discharged to the environment.	Benefits outweigh cost/sacrifice.	Yes **C 7.6**
During well kill activities, returned well kill fluids and produced water will be processed through the water treatment package of the dedicated fluid and gas handling bleed off package. Water will be treated to less than 30 ppm oil in water content prior to discharge to the environment. If this cannot be met, fluids will be returned to shore.	F: Yes. CS: Minimal cost. Standard practice.	Reduced toxicity to the marine environment when discharged.	Benefits outweigh cost/sacrifice.	Yes **C 7.7**
Professional Judgement – Eliminate				
Brine, WBM and clean-up fluids routed via the MODU mud system which are contaminated with < 1% base oil or NWBM captured on the MODU not discharged to the marine environment.	F: Yes. CS: Not standard practise. Significant cost, labour and resources required due to volumes of brine, WBM and clean-up fluids that would require handling from being generated from the permanent plugging activities. Other cost/sacrifice elements which are considered include: • further treatment of the fluids onshore is required to ensure a standard suitable for	Slight reduction in consequence to the marine environment due to small volume of oil (<1% by content) not being discharged. However, generates onshore disposal consequences.	Cost/sacrifice outweighs benefits.	No

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	landfill: Class II disposed locally (e.g. Karratha); Class III landfill requires transport to Geraldton or Perth - potential halt to permanent plugging activity if transfer operations are delayed due to weather or operational issues - additional environmental impact incurred (air emissions) from vessel use and onshore trucking for transporting fluids - disposal via onshore treatment does not eliminate an environmental impact. These options have their own impacts and therefore disadvantages if implemented.			
Professional Judgement – Substitute				
No additional controls identified.				
Professional Judgement – Engineered Solution				
Mud pit wash residue will be measured for oil content before discharge.	F: Yes. CS: Minimal cost. Standard practice.	Ensuring less than 1% oil content will provide a small reduction in consequence when residue is discharged to the environment.	Benefits outweigh cost/sacrifice.	Yes **C 7.8**
Drilled cement returned to the MODU will be discharged below the water line.	F: Yes. CS: Minimal cost. Standard practice.	Discharge of drilled cement below the water line will reduce carriage and dispersion of solids, thereby reducing the consequence of solids discharges during the Petroleum Activities Program.	Benefits outweigh cost/sacrifice.	Yes **C 7.9**
Water quality and/or sediment monitoring of drilling fluids and cement/formation cuttings to verify impact during activity.	F: Yes. CS: - For in-water sampling using ROV – Time and logistics for tool change-out from operational tools to specialised scientific sampling tools. - Additional personnel onboard to operate ROV and coordinate sampling program. - Low ROV availability due to operations can	No environmental benefit would be gained by implementing monitoring during the activity. Monitoring could be used to inform additional control measures in future drilling activities; however, there is a considerable body of scientific literature about potential impacts of drilled cement and	Disproportionate. Cost/sacrifice outweighs benefit to be gained in the context of existing environment (deepwater, open ocean communities with no proximity to sensitive benthic communities or receptors).	No

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	limit time to perform environment monitoring. - If additional ROV is required on the MODU, deck space and resources to run, store, service ROV. - Resources for sample processing (space, equipment, personnel).	impacts are generally well understood. Furthermore, it is not guaranteed that additional controls would be feasible, or if they would provide any environmental benefit, and the volumes that are proposed to be discharged are so small that meaningful monitoring may not be possible.	Although adoption of this control could be used to verify EPOs associated with drilling mud and cutting discharge, alternative controls identified achieve an appropriate outcome.	
Use SCE with secondary treatment for NWBM during milling: Thermomechanical systems (to achieve less than 1% average oil on solids).	F: No –A thermomechanical dryer is designed for use with cuttings, not steel swarf. The presence of swarf in the return fluid will damage the equipment screens. CS: The cost to redesign and manufacture a system that could be used with steel swarf in cuttings is estimated at many millions of dollars.	A minor reduction in consequence would be achieved by reducing the average oil on solids discharged on a small volume of cement, swarf and cuttings that would be produced.	Disproportionate. Not feasible with current systems and cost/sacrifice outweighs benefit to be gained in the context of existing environment and plugging activities.	No
If NWBM is used for milling, separate and recover swarf, cement cuttings and formation rock for processing and landfill disposal onshore (skip and ship) (to reduce residual OOC to marine environment).	F: Yes. CS: Primary cost/ sacrifice of this option is the addition of a swarf handling unit which would be required to separate and recover the swarf from the milling fluid. Additonal cost sacrifice is the additional handling required to transport milled swarf, cement cuttings formation rock cuttings to an onshore disposal location. Other cost/sacrifice elements which are considered include: - further treatment of milling debris onshore is required to ensure a standard suitable for landfill: Class II disposed locally (e.g. Karratha); Class III landfill requires transport to Geraldton or Perth - increased risk of unplanned vessel collision or loss of cuttings during transfer activities - potential halt to permanent plugging activity if transfer	A minor reduction in consequence would be achieved by reducing the NWBM discharged on milled swarf, cement cuttings formation rock cuttings discharged to the marine environment (up to 5 m^3).	Disproportionate. Given the low current risk rating, the high cost/ sacrifice outweighs the benefit gained for the Petroleum Activities Program. Impact assessment has determined no sensitive benthic receptors in the vicinity and a low level of impact potential from the OOC on the milled swarf, cement cuttings and formation rock discharge; therefore, benefit to be gained from collection and onshore disposal is disproportionate to the risks introduced by relocating NWBM on milled swarf, cement cuttings and formation rock (including if	No

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	operations are delayed due to weather or operational issues - additional environmental impact incurred (air emissions) from vessel use and onshore trucking for transporting milling cuttings - disposal via landfill and/or treatment does not eliminate an environmental impact. These options have their own impacts and therefore disadvantages if implemented.		an alternative system which does not use transport containers was implemented).	
Time-restricted discharge of WBM and/or cuttings to align with tide/current or other oceanographic events.	F: Yes. CS: Disruption to P&A operations in having to stop activities at a time when discharge of WBM and/or solids might not be permitted. Additional mud storage volume required.	Given the offshore location, oceanographic changes are unlikely to significantly affect the dispersion of solids and therefore no environmental benefit would be gained.	Disproportionate. The cost/sacrifice outweighs the benefit gained – No hard coral or other light-dependent benthic primary producer communities in the vicinity of wells to rationalise phased/timed discharge.	No

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, **Section 2.6.1**), Woodside considers the adopted, standard 'good practice' controls appropriate to manage the impacts of drilled cement and drilling fluids discharges.

A range of engineered solutions and other elimination options were considered to further reduce the impact of planned discharge of drilled cement, drilling fluids, residual hydraulic flying lead fluids, well clean-out and kill fluids, as well as metal and cement cuttings and flocculant and grit from infrastructure removal to ALARP; however, technical and operational challenges, safety and environmental risk and additional financial costs resulted in these options being rejected on the basis that they were grossly disproportionate to the potential environmental benefit gained. As no reasonable additional/alternative controls were identified that would further reduce the impacts, which due to the low sensitivity of the environment are already low, without grossly disproportionate sacrifice, the impacts are considered ALARP.

Demonstration of Acceptability

Acceptability Statement

The impact assessment has determined that, given the adopted controls, routine and non-routine discharges of drilled cement, swarf, formation rock, WBM and NWBM, residual hydraulic flying lead fluids, well clean-out and kill fluids, as well as metal and cement cuttings and flocculant and grit from infrastructure removal result in negligible, localised impact (<1 month) on habitat (but not affecting ecosystem function), physical and biological attributes.

The adopted controls are considered consistent with industry good practice and professional judgement. On the basis of the environmental impact assessment outcomes and Woodside's criteria for acceptability outlined in **Section 2.7.2**, this is considered an acceptable level of impact.

Environmental Performance Outcomes, Standards and Measurement Criteria

Outcomes	*Controls*	*Standards*	*Measurement Criteria*

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EPO 7 No impact to water quality or marine biota greater than a consequence level of F[14] from discharge of cement cuttings, formation cuttings, WBM or NWBM fluids, well clean-out fluids and well kill fluid, and grit and flocculant during the Petroleum Activities Program.	**C 7.1** Fluids, flocculant and additives planned to be used and intended or likely to be discharged to the marine environment will have an environmental assessment completed before use.	**PS 7.1** All chemicals, planned to be used and intended or likely to be discharged to the marine environment reduced to ALARP using the chemical assessment process.	**MC 7.1.1** Records demonstrate chemical selection, assessment and approval process selected chemicals is followed.
	C 7.2 Chemical reviews will be performed on all previously approved chemicals to confirm potential chemical impacts are reduced to ALARP.	**PS 7.2** Acceptability of previously approved chemicals are re-evaluated to ensure ALARP and alternatives are considered.	**MC 7.2.1** Records confirm reviews have occurred, and any actions/changes are implemented.
	C 7.3 Written justification process will be followed prior to use of NWBM.	**PS 7.3** NWBMs only used where written justification process has been followed.	**MC 7.3.1** Records demonstrate a formal justification has been completed before using NWBM.
	C 7.4 Fluids circulated from the well to the MODU containing greater than 1% NWBM will be retained and disposed of onshore, or injected into the well and isolated from the marine environment.	**PS 7.4** Fluids containing >1% NWBM taken onshore or injected into the well and isolated from the marine environment.	**MC 7.4.1** Records demonstrate fluids containing >1% NWBM have been taken onshore or injected into the well and isolated from the marine environment.
	C 7.5 Bulk operational discharges conducted under MODU's PTW system (to operate discharge valves/pumps).	**PS 7.5** All bulk operational discharges conducted under MODU's PTW system.	**MC 7.5.1** Records demonstrate that bulk discharges are conducted under the MODU PTW system.
	C 7.6 Brine, WBM and clean-up fluids routed via the MODU mud system which are contaminated with base oil or NWBM, will be captured on the MODU for discharge if oil concentration is less than 1% by volume. If discharge specification not met the fluid will be returned to shore or injected intothe well and isolated from the marine environment.	**PS 7.6** Achieve oil concentration <1% by volume prior to discharge.	**MC 7.6.1** Records demonstrate that discharge criteria were met prior to discharge or contained.
	C 7.7 Fluids received to the MODU during well kill will be treated by the bleed off	**PS 7.7** Less than 30 ppm oil content achieved before discharge of fluids from	**MC 7.7.1** Records demonstrate that discharge criteria were met before discharge or fluids were contained.

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[14] Defined as 'F - No lasting effect (less than one month). Localised impact not significant to areas or items of cultural significance)'.

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	package before discharge or contained.	well bleed off package water filtration system.	
	C 7.8 Mud pit wash residue will be measured for oil content before discharge.	**PS 7.8** Less than 1% by volume oil content achieved before discharge of mud pit wash residue.	**MC 7.8.1** Records after pit clean-out (for pits potentially contaminated with base oil) demonstrate mud pit wash residue was less than 1% by volume oil content before discharge.
	C 7.9 Drilled cement, formation rock and swarf returned to the MODU will be discharged below the water line to reduce carriage and dispersion of solids by surface currents.	**PS 7.9** Drilled cement, formation rock and swarf discharged below the water line.	**MC 7.9.1** Records confirm solids discharge chute/line is below the water line.

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6.6.6 Routine and Non-routine Discharges: Wet Cement, Cementing Fluids, Subsea Fluids, Unused Bulk Products and Marine Riser Clean-out

Context		
Installation of permanent barriers – **Section 3.11.1.4** BOP and subsea control systems – **Section 3.11.1.1** Marine growth removal – **Section 3.10.6** IMR Activities – **Section 3.10.8** Marine riser clean out – **Section 3.12.1**	Physical Environment – **Section 4.4** Biological Environment – **Section 4.5**	Stakeholder Consultation – **Section 5**

Impact Evaluation Summary														
Source of Impact	***Environmental Value Potentially Impacted***							***Evaluation***						
	Soil and Groundwater	Marine Sediment	Water Quality	Air Quality (incl Odour)	Ecosystems/ Habitat	Species	Socioeconomic	Decision Type	Consequence/Impact	Likelihood	Risk Rating	ALARP Tools	Acceptability	Outcome
Routine and non-routine discharge of wet cement, cementing fluids, subsea control fluids (e.g. BOP control fluids), marine growth cleaning fluids and marine riser clean-out debris to the marine environment		X	X		X			A	F	-	-	GP PJ	Broadly Acceptable	EPO 8

Description of Source of Impact

Wet Cement and Cementing Fluids

Cementing fluids, including cementing mix water, may require discharge to the marine environment under various scenarios. After each cement job, leftover cement slurry in the cement pump unit and the surface lines is flushed and discharged to the sea to prevent clogging of the lines and equipment. This is estimated to be about 20 m³ per well (based on up to four cement jobs per well, with 5 m³ discharged per job). In the event that the cement job does not meet barrier requirements, the cement will be drilled out and cement operations redone.

Cement spacers can be used as part of the cementing process, within the well casing, to assist with cleaning the casing sections before cement flows through.

Following completion of all plugging operations at the end of the campaign, excess cement, bentonite and barite (dry bulk, after well operations are completed) will either be: provided to the next operator at the end of the plug and abandon program (as it remains on the rig); or, if these options aren’t practicable, discharged to the marine environment as dry bulk or as a slurry. Maximum discharges are 100 tonnes of cement, 120 tonnes of barite and 120 tonnes of bentonite. However, these volumes are highly conservative and discharge volumes (if required) are likely to be much smaller. The process that will be followed to determine discharge is the last option is presented in **Figure 6-1**.

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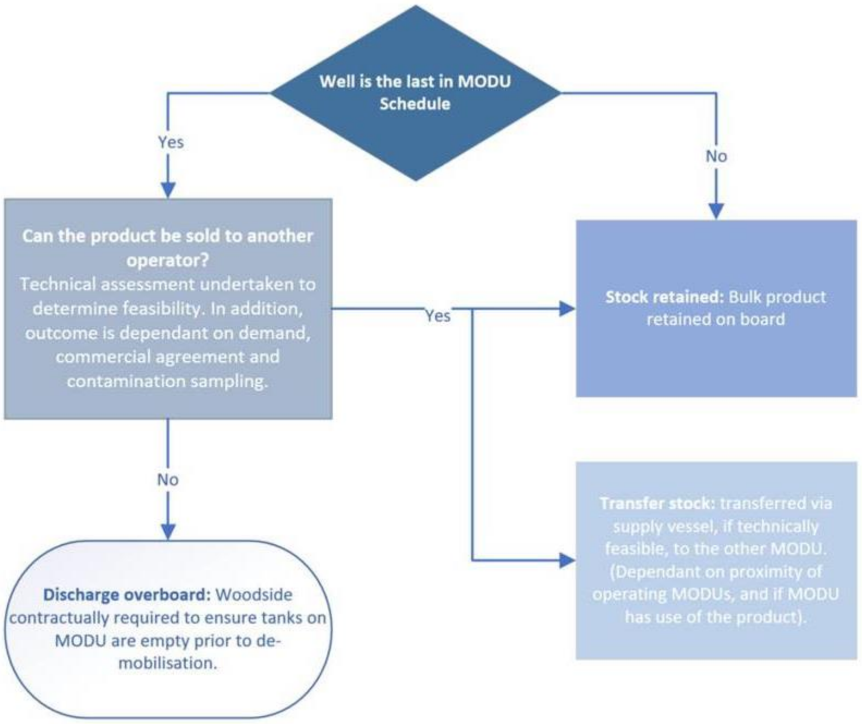

Figure 6-1: Management process for excess bulk product

Upon arrival on location at the Operational Area, the MODU may need to perform a cement unit test, or 'dummy cement job'. Discharges from the test are made through the usual cement unit discharge line, which may be up to 10 m, above the sea surface, and occur as a cement slurry. The slurry is usually a mix of cement and water (about 10 m^3); however, may sometimes contain stabilisers or chemical additives.

Subsea Fluids (BOP / Xmas tree and Well Plugging Activity Control Fluids)

Subsea fluids are likely to be released during permanent plugging for abandonment activities including Xmas tree removal. These substances include hydraulic fluids, BOP control fluids and subsea control fluids.

The BOP is required to be regularly function tested when subsea, as defined by legislative requirements. The BOP is function tested during assembly and maintenance and during operation on the seabed. As part of this testing, small volumes of BOP control fluid (generally consisting of water mixed with a glycol based detergent or equivalent water based anti-corrosive additive) is released to the marine environment. The BOP will be function tested about every seven days (when a pressure test is not occurring) and pressure tested about every 21 days as per API 53 (an American Petroleum Institute standard for Well Control Equipment Systems for Drilling Wells). The maximum volume of BOP control fluid per function is up to about 90 L per test.

All other plug and abandon activities that result in subsea control fluid discharges are likely to only discharge small, intermittent volumes.

During marine growth removal activities it may be necessary to remove marine growth from the Xmas trees and wellheads using acid (typically sulphamic acid).

Marine Riser Clean Out

There is potential for the marine riser and BOP to be susceptible to rust and other minor build up between wells. This can lead to operational issues. To avoid this, the marine riser will be cleaned by running riser brushes through it while the riser and BOP are suspended in open water. The BOP cavities will also be cleaned before deployment and, if equipment needs to be cleaned after deployment, large diameter brushes, clean drill pile and high rate circulation subs will be available to enable riser cleaning/flushing to the MODU mud pits. If debris continues to be a problem, the riser will be disconnected and an ROV will be used to flush the remaining debris from the top of the Xmas tree cap.

Impact Assessment

Pelagic and benthic habitats in the Operational Area are considered to be of low sensitivity (no known significant benthic habitat or infauna habitat). Although the Ancient Coastline at 125 m Depth Contour KEF overlaps with the Operational Area, the values and sensitivities of this KEF occur on a broad scale outside of the Operational Area (**Section 4.5.3**).

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Coupled with the low toxicity of the fluids to be used for the Petroleum Activities Program, the likelihood of any significant impact to marine biota is considered to be low.

Cement

Impacts of cement on the marine environment are associated mainly with smothering of surrounding benthic and/or infauna communities. Cement is the most common material currently used in artificial reefs around the world (Carral et al, 2020) and is not expected to pose any toxicological impacts to receptors from leaching or direct contact. The impact of cement discharge at the seabed will be limited to any surrounding benthic and/or infauna communities, in a small localised area immediately around the well.

Minimum cement (50 t), barite (60 t) and bentonite (60 t) volumes are required to be stored on the MODU for use in well control and plug and abandon activities. While volumes are calculated before use to minimise excess, the requirement for additional volumes on the MODU for operational contingencies means there may be greater than the minimum onboard at the end of campaign. Discharge of excess cement, barite and bentonite (if required) may occur as dry bulk or as a slurry. Dry bulk has the potential to disperse across a wider area, but at lower concentration, compared to slurry which would have a greater tendency to settle on the seafloor closer to the well location. In either case, discharges are not expected to widely disperse before settling on the seabed.

Reduction in water quality from bulk discharges will be temporary and subject to rapid dispersion and dilution by prevailing currents away from the discharge location. Impacts to plankton populations will therefore be localised over the duration of the plume and would be expected to return to previous conditions within a relatively short period of time.

The potential impacts to benthic communities caused by smothering from a surface release of cement are expected to be minimal due to the high dispersal by ocean currents and short-term duration of these discharges. Cement is inert and does not pose toxicological impacts. As described in **Section 6.6.5**, barite and bentonite have very low toxicities and are considered by OSPAR to pose little or no risk to the environment (PLONAR). They may, however, cause physical damage to benthic organisms by abrasion or clogging, or through changes in sediment texture that can inhibit the settlement of planktonic polychaete and mollusc larvae (Swan *et al.,* 1994). However, these impacts are expected to be negligible, due to the low volumes that will be discharged given that this is a one off discharge and due to and rapid biodegradation and dispersion of bulk discharges (Terrens *et al.,* 1998). Any impacts to soft sediment communities is not expected to affect the diversity or ecosystem function in this area and is only considered a localised impact with no lasting effect.

Cementing Fluids and Subsea Fluids (BOP / Xmas tree and Well Plugging Activity Control Fluids)

All chemicals that may be operationally released or discharged to the marine environment must be selected and approved as per the Chemical Selection and Assessment Environment Guideline (**Section 3.15.1**). Therefore, any chemicals selected and potentially released are expected to be of low toxicity and biodegradable. Additionally, where cements have been mixed in excess and cannot be reused or returned to shore, these will be turned into a slurry. As chemicals have initially been chosen based on the environmental performance and an ALARP assessment, additional dilution before discharge further reduces the environment impact to water quality, sediment quality and marine benthic and/or infauna communities. Given the minor quantities of routine and non-routine planned discharges, short discharge durations and the low toxicity and high dispersion in the open, offshore environment, any impacts on the marine environment are expected to be negligible.

No cumulative impacts to water quality are expected to occur, as discharged cements etc are predicted to settle in between the plug and abandon activities for each well.

Demonstration of ALARP				
Control Considered	***Control Feasibility (F) and Cost/Sacrifice (CS)***[15]	***Benefit/Reduction in Impact***	***Proportionality***	***Control Adopted***
Legislation, Codes and Standards				
No additional controls identified.				
Good Practice				
Fluids and additives intended or likely to be discharged to the marine environment will have an environmental	F: Yes. CS: Minimal cost. Standard practice.	Environmental assessment of chemicals will reduce the consequence of impacts resulting from	Benefits outweigh cost/sacrifice.	Yes **C 7.1**

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Demonstration of ALARP				
Control Considered	***Control Feasibility (F) and Cost/Sacrifice (CS)[15]***	***Benefit/Reduction in Impact***	***Proportionality***	***Control Adopted***
assessment completed before use.		discharges to the marine environment, by ensuring chemicals have been assessed for environmental acceptability. Planned discharges are required for the safe execution of activities and therefore no reduction in likelihood can occur.		
Chemical reviews will be performed on all previously approved chemicals to confirm potential chemical impacts are reduced to ALARP.	F: Yes. CS: Minimal cost. Standard practice.	Reviews will ensure chemicals selected for Drilling and Completions fluids remain ALARP.	Benefits outweigh cost/sacrifice.	Yes **C 7.2**
Bulk operational discharges conducted under MODU's PTW system (to operate discharge valves/pumps).	F: Yes. CS: Minimal cost. Standard practice.	The MODU's PTW may slightly reduce the likelihood of bulk discharges occurring, but it is unlikely to be significant, given that bulk discharges are often operationally required and cannot be eliminated.	Benefits outweigh cost/sacrifice.	Yes **C 7.5**
Professional Judgement – Eliminate				

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Demonstration of ALARP				
Control Considered	***Control Feasibility (F) and Cost/Sacrifice (CS)***[15]	***Benefit/Reduction in Impact***	***Proportionality***	***Control Adopted***
Do not use BOP control fluids.	F: No. BOP control fluids are critical to the operation of the BOP. CS: Not considered, control not feasible.	Not considered, control not feasible.	Not considered, control not feasible.	No
Return wet cement and other down-well products onshore for treatment/disposal.	F: Yes. However, cement slurry may harden during transport, introducing difficulty in handling and transportation. CS: The cost involved in transporting cement for shore-based disposal is significant.	No discharge of cement to the marine environment would eliminate the likelihood and consequence of impacts from such activities.	Disproportionate. Given the non-toxic nature of cement, the cost/sacrifice outweighs the benefit gained.	No
Return bulk cement, barite and bentonite for onshore disposal	F: No. The technical requirements to be able to undertake this safely are unresolved due to: • Significant risks with tank high pressure differentials to transfer material onshore. • High risk with the vessel to waste truck transfer due to tank corrosion concerns and pressure relief valve issues. CS: Not considered. Control not feasible.	Not considered, control not feasible.	Not considered, control not feasible.	No
Options for use of excess bulk cement, bentonite and barite will be managed as per Figure 6-1 and only discharged to the marine environment as a last option.	F: Yes. However, the cement may not meet the required technical specifications, and hence not be usable. CS: Minor.	Using excess bulk cement, bentonite and barite for subsequent campaigns would eliminate the bulk discharge to the marine environment and eliminate the likelihood and consequence of impacts from such activities.	Benefits outweigh cost/sacrifice.	Yes **C 8.1**
Professional Judgement – Substitute				
No additional controls identified.				
Professional Judgement – Engineered Solution				

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<table>
<tr><th colspan="5">Demonstration of ALARP</th></tr>
<tr><th>Control Considered</th><th>Control Feasibility (F) and Cost/Sacrifice (CS)[15]</th><th>Benefit/Reduction in Impact</th><th>Proportionality</th><th>Control Adopted</th></tr>
<tr><td colspan="5">No additional controls identified.</td></tr>
<tr><td colspan="5">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, Section 2.6.1), Woodside considers the adopted controls appropriate to manage the impacts of cement, cementing fluids and subsea fluids. As no reasonable additional/alternative controls were identified that would further reduce the impacts without grossly disproportionate sacrifice, the impacts are considered ALARP.</td></tr>
<tr><th colspan="5">Demonstration of Acceptability</th></tr>
<tr><td colspan="5">Acceptability Statement
The impact assessment has determined that, given the adopted controls, routine and non-routine cement, cementing fluids, subsea well fluids, unused bulk products and other down-well may result in localised impacts with no lasting effect (<1 month) to marine sediment, water quality and habitat (but not ecosystems).
The adopted controls are considered consistent with industry good practice and professional judgement. On the basis of the environmental impact assessment outcomes and Woodside’s criteria for acceptability outlined in Section 2.7.2, this is considered an acceptable level of impact.</td></tr>
</table>

<table>
<tr><th colspan="4">Environmental Performance Outcomes, Standards and Measurement Criteria</th></tr>
<tr><th>Outcomes</th><th>Controls</th><th>Standards</th><th>Measurement Criteria</th></tr>
<tr><td rowspan="4">EPO 8
No impact to water quality or marine biota greater than a consequence level of F[16] from discharging cement, cementing fluids, subsea well fluids and unused bulk products during the Petroleum Activities Program.</td><td>C 7.1
See Section 6.6.5</td><td>PS 7.1
See Section 6.6.5</td><td>MC 7.1.1
See Section 6.6.5</td></tr>
<tr><td>C 7.2
See Section 6.6.5</td><td>PS 7.2
See Section 6.6.5</td><td>MC 7.2.1
See Section 6.6.5</td></tr>
<tr><td>C 7.5
See Section 6.6.5</td><td>PS 7.5
See Section 6.6.5</td><td>MC 7.5.1
See Section 6.6.5</td></tr>
<tr><td>C 8.1
Options for use of excess bulk cement, bentonite and barite will be managed as per Figure 6-1 and only discharged to the marine environment as a last option.</td><td>PS 8.1
No bulk cement, bentonite or barite discharged without documented ALARP assessment.</td><td>MC 8.1.1
Records demonstrate that prior to discharge of excess bulk cement, bentonite or barite, options for use were assessed.</td></tr>
</table>

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[16] Defined as ‘No lasting effect (less than one month) or negligible. Localised impact not significant to areas or items of cultural significance)’.

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6.6.7 Routine and Non-routine Atmospheric Emissions

Context

Permanent Plugging Activities – **Section 3.10** Project Vessels – **Section 3.8**	Socioeconomic and Cultural – **Section 4.6**	Stakeholder Consultation – **Section 5**

Impact Evaluation Summary

Source of Impact	***Environmental Value Potentially Impacted***							***Evaluation***						
	Soil and Groundwater	Marine Sediment	Water Quality	Air Quality (incl Odour)	Ecosystems/ Habitat	Species	Socioeconomic	Decision Type	Consequence/Impact	Likelihood	Risk Rating	ALARP Tools	Acceptability	Outcome
Exhaust emissions from internal combustion engines and incinerators on MODU, project vessels and helicopters				X				A	F	-	-	LCS GP	Broadly acceptable	EPO 9
Flaring of residual gas and produced formation water				X				A	F	-	-			
Venting of residual gas				X				A	F	-	-			

Description of Source of Impact

Internal combustion engines and incinerators

Atmospheric emissions will be generated by the MODU, project vessels and helicopters from internal combustion engines (including all equipment and generators, which may be diesel powered and/or LNG powered) and incineration activities (including onboard incinerators) during the Petroleum Activities Program. Emissions will include SO_2, NO_x, ozone depleting substances, CO_2, particulates and volatile organic compounds (VOCs).

Flaring / venting of residual gas, oil and produced water

During plugging for abandonment, residual hydrocarbons from the well may need to be vented or flared. Up to 1.55 MMscf of gas may be vented or flared per well. During well bleed-off activities, up to about 155 m^3 of produced fluid may be bled from the well and brought back to the MODU. These fluids will be flared, or discharged to the marine environment after treatment via the well bleed off water treatment package which cycles the water through a water filtration system with solids and polishing (see **Section 6.6.5**).

Venting of residual gas in case of well kick

During permanent plugging, a kick may occur. A kick is an undesirable influx of formation fluid into the well bore. The resultant effect would be a release of a small volume of greenhouse gases via the degasser to the atmosphere during well control operations, known as 'venting'. Venting is required to ensure well integrity is maintained in the event of a kick, thereby avoiding an emergency condition.

Impact Assessment

Fuel combustion, incineration, and flaring have the potential to result in 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 project vessels (which will lead to the rapid

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dispersion of the low volumes of atmospheric emissions), the potential impacts are expected to be localised and of no lasting effect.

Venting of hydrocarbon gases may result in a temporary gas plume and a localised contribution to greenhouse gas emissions. There is potential for human health effects for workers in the immediate vicinity of atmospheric emissions. However, the closest sensitive residential receptor is the town of Dampier, approximately 170 km south-east of the Operational Area; therefore any risks associated with off-site human health effects are negligible beyond the immediate zone of release and dispersion. Given the isolated location of the Petroleum Activities Program (which will lead to the rapid dispersion of the low volumes of atmospheric emissions) the potential impacts are expected to be localised and no cumulative impacts are anticipated when considered in the context of existing oil and gas operations in the region.

Summary of Potential Impacts to Environmental Value(s)

Given the adopted controls, it is considered that the release of a small volume of greenhouse gases will not result in a potential impact greater than a temporary impact to local air quality with no lasting effect.

Demonstration of ALARP

Control Considered	***Control Feasibility (F) and Cost/Sacrifice (CS)***[17]	***Benefit/Reduction in Impact***	***Proportionality***	***Control Adopted***
Legislation, Codes and Standards				
Marine Order 97 (Marine Pollution Prevention – Air Pollution), which details requirements for: • International Air Pollution Prevention (IAPP) 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.	F: Yes CS: Minimal cost	Legislative requirements to be followed may slightly reduce the likelihood of air pollution.	Control based on legislative requirements – must be adopted	Yes **C 9.1**
Offshore Petroleum and Greenhouse Gas Storage (Resource Management and Administration) Regulations 2011: Accepted Well Operations Management Plan (WOMP). The WOMP describes the well integrity outcomes, control measures and performance criteria used to demonstrate how the risk of loss of well integrity is managed to ALARP including the well design and barriers to be used to prevent a	F: Yes CS: Minimal cost. Standard practice.	Compliance with an accepted WOMP that aligns with industry guidance and good practice will ensure a number of barriers are in place and verified, reducing the likelihood of loss of well integrity occurring. Although the consequence of a blowout would not be reduced, the reduction in likelihood reduces the overall risk.	Control based on legislative requirements – must be adopted	Yes **C 9.2**

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1 Qualitative measure

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Demonstration of ALARP				
Control Considered	***Control Feasibility (F) and Cost/Sacrifice (CS)***[17]	***Benefit/Reduction in Impact***	***Proportionality***	***Control Adopted***
loss of well integrity, which aligns with industry guidance and good practice.				
As-built checks shall be completed during well operations as described in the WOMP.	F: Yes. CS: Minimal cost, Standard practice.	Reduces likelihood of occurrence. No reduction in consequence will occur.	Benefits outweigh cost/sacrifice.	Yes **C 9.3**
Good Practice				
Flaring restricted to a duration necessary to perform the activity for well kill.	F: Yes CS: Minimal cost. Standard practice for Woodside activities	Reduces the likelihood of atmospheric emissions impacting air quality. Consequence remains unchanged.	Benefits outweigh cost/sacrifice.	Yes **C 5.1**
Oil burner will operate efficiently to maximise combustion.	F: Yes. CS: Minimal cost. Standard practice.	This control results in a reduction in likelihood of atmospheric emissions impacting air quality. Consequence remains unchanged.	Benefits outweigh cost/sacrifice.	Yes **C 9.4**
Subsea BOP installed and function tested during permanent plugging operations. The BOP shall meet the Woodside Well Control Procedure, Woodside Engineering Standard – Rig Equipment and shall be subject to API Standard 53 BOP Risk Assessment.	F: Yes. CS: Standard practice. Required by Woodside standards.	BOP testing reduces the volume of gas vented in the event of a well kick.	Benefits outweigh cost/sacrifice.	Yes **C 9.5**
Re-inject wellbore hydrocarbons into the reservoir prior to well abandonment, where practicable.	F: Yes. CS: Minimal cost. Reduced overall risk.	Reduces the likelihood of atmospheric emissions impacting air quality through reducing volume of hydrocarbons required to be flared/vented.	Benefits outweigh cost/sacrifice.	Yes **C 9.6**
Well control bridging document for alignment of Woodside and the MODU contractor to manage the equipment and procedures for preventing and handling a well kick.	F: Yes. CS: Minimal cost. Standard practice for Woodside activities.	Implementing equipment and procedures in the well control bridging document will reduce the volume of gas vented in the event of a well kick.	Benefits outweigh cost/sacrifice.	Yes **C 9.7**
Professional Judgement – Eliminate				
Do not combust fuel.	F: No. There are no MODUs or 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

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Demonstration of ALARP				
Control Considered	***Control Feasibility (F) and Cost/Sacrifice (CS)***[17]	***Benefit/Reduction in Impact***	***Proportionality***	***Control Adopted***
Do not vent during well kick.	F: No. Venting is a safety-critical activity required in the event of a kick to reduce pressure build up. CS: Not considered, control not feasible.	Not considered, control not feasible.	Not considered, control not feasible.	No
Do not vent or flare well fluids during well kill operations.	F: No. venting or flaring of well fluids is a safety-critical activity required to facilitate permanent plugging operations.	Not considered, control not feasible.	Not considered, control not feasible.	No
Professional Judgement – Substitute				
None identified				
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 (i.e. Decision Type A, **Section 2.6.1**), Woodside considers the adopted controls are considered good oil-field practice/industry best practice, and appropriate to manage the impacts of fuel combustion, flaring, incineration and venting. As no reasonable additional/alternative controls were identified that would further reduce the impacts without grossly disproportionate sacrifice, the impacts are considered ALARP.				

Demonstration of Acceptability
Acceptability Statement The impact assessment has determined that, given the adopted controls, routine atmospheric emissions from fuel combustion, flaring, incineration, and venting may result in localised impacts to air quality with no lasting effect (<1 month). The adopted controls are considered consistent with industry legislation, codes and standards, and professional judgement and meet the requirements of Australian Marine Orders. On the basis of the environmental impact assessment outcomes and Woodside's criteria for acceptability outlined in **Section 2.7.2**, this is considered an acceptable level of impact.

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Environmental Performance Outcomes, Standards and Measurement Criteria			
Outcomes	***Controls***	***Standards***	***Measurement Criteria***
EPO 9 Emissions to atmosphere as a result of fuel combustion, incineration, venting and flaring limited to those necessary to maintain well integrity and complete the Petroleum Activities Program.	**C 9.1** Marine Order 97 (Marine Pollution Prevention – Air Pollution) which details requirements for: • International Air Pollution Prevention (IAPP) 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 9.1** MODU and project vessels compliant with Marine Order 97 (marine pollution prevention – air pollution) 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 9.1.1** Marine Assurance inspection records demonstrate compliance with Marine Order 97.
	C 9.2 OPGGS (Resource Management and Administration) Regulations 2011: accepted WOMP which describes the well integrity outcomes, control measures and performance criteria used to demonstrate how the risk of loss of well integrity is managed to ALARP which aligns with industry guidance and good practice.	**PS 9.2** Wells permanently plugged in compliance with the accepted WOMP.	**MC 9.2.1** Acceptance letter from NOPSEMA demonstrates the WOMP was accepted by NOPSEMA before the activity commenced.
			MC 9.2.2 Records demonstrate the verification documentation as listed in the WOMP is available.
	C 9.3 As-built checks shall be completed during well operations as described in the WOMP.	**PS 9.3** Achieve a minimum acceptable standard of well integrity.	**MC 9.3.1** Records show Well Acceptance Criteria are developed for each well.
			MC 9.3.2 Records demonstrate Well Acceptance Criteria have been met.
	C 4.1 Refer **Section 6.6.3**	**PS 4.1** Refer **Section 6.6.3**	**PS 4.1.1** Refer **Section 6.6.3**
	C 9.4 Oil burner will operate efficiently to maximise combustion.	**PS 9.4** Oil burner will have combustion efficiency greater than 99%.	**MC 9.4.1** Records demonstrate that oil burner is greater than 99% efficient.

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	C 9.5 Subsea BOP installed and function tested during permanent plugging operations. The BOP shall meet the Woodside Well Control Procedure, Woodside Engineering Standard – Rig Equipment and shall be subject to API Standard 53 BOP Risk Assessment.	**PS 9.5** Subsea BOP specification, installation and function testing compliant with internal Woodside Standards and international requirements (API Standard 53) as agreed by Woodside and MODU contractor.	**MC 9.5.1** Records demonstrate that BOP and BOP control system specifications and function testing were in accordance with minimum standards for the expected permanent plugging conditions as agreed by Woodside and MODU contractor.
	C 9.6 Re-inject wellbore hydrocarbons into the reservoir prior to well abandonment, where practicable.	**PS 9.6** Wellbore hydrocarbons reinjected into the reservoir, where practicable.	**MC 9.6.1** Records confirm assessment completed to ensure wellbore hydrocarbons re-injected where practicable.
	C 9.7 Well Control Bridging Document (WCBD) for alignment of Woodside and the MODU contractor to manage the equipment and procedures for preventing and handling a well kick.	**PS 9.7** Well is permanently plugged in accordance with the contractor WCBD to ensure no unplanned emissions to air from a well kick, during operations.	**MC 9.7.1** Records demonstrate well permanently plugged in accordance with WCBD.

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6.6.8 Routine Light Emissions: External Lighting on MODU and Project Vessels

Context		
Project vessels – **Section 3.8**	Biological Environment – **Section 4.5** Socioeconomic and Cultural – **Section 4.6**	Stakeholder Consultation – **Section 5**

Impact Evaluation Summary														
Source of Impact	***Environmental Value Potentially Impacted***							***Evaluation***						
	Soil and Groundwater	Marine Sediment	Water Quality	Air Quality (incl Odour)	Ecosystems/ Habitat	Species	Socioeconomic	Decision Type	Consequence/Impact	Likelihood	Risk Rating	ALARP Tools	Acceptability	Outcome
External light emissions onboard MODU and project vessels					X		A	F	-	-	-	PJ	Broadly Acceptable	EPO 10

Routine light emissions include light sources that alter the ambient light conditions in an environment. The MODU and project vessels will routinely use external lighting to navigate and conduct safe operations at night throughout the Petroleum Activities Program. External light emissions from the MODU and project vessels are typically managed to maintain good night vision for crew members. Vessel/MODU lighting will also be used to communicate the vessel's presence to other marine users (i.e. navigation/warning lights). Lighting is required for safely operating project vessels/MODU and cannot reasonably be eliminated.

The vessels/MODU that may be required for the Petroleum Activities Program are outlined in **Section 3.8**. External lighting is located on vessel/MODU decks, with most external lighting directed towards working areas such as the main decks. These areas are typically <20 m above level for vessels, and ~30 m for MODUs. Indicative timing for activities are provided in **Section 3.5** and may occur throughout the year.

Flaring, which is a relatively bright light source, is sometimes necessary for short periods of time during permanent plugging of wells (**Section 3.11.1**). It is planned that there will be limited flaring of gas or liquids during the Petroleum Activities Program. The base case is that tubing fluids are bullheaded back into wells, but hydrocarbons present in the annuli of the two production wells may be bled off to the MODU. If bullheading of the tubing is not successful, the tubing gas may also be flared. Flaring is for a limited duration as it is constrained by the volume of gas/liquids in the annulus and well bore. It is estimated that there would be a maximum of 1,080-minutes (~18-hours) of flaring. Flaring will only be at low flow rates, unlike unload operations, and would take place during both daytime and nightime.

Lighting from vessels/MODU may appear as a direct light source from an unshielded lamp with direct line of sight to the observer or through sky glow. Direct lighting falling upon a surface is referred to as light spill. Sky glow is the diffuse glow caused by light that is screened from view, but through reflection and refraction creates a glow in the atmosphere. The distance at which direct light and sky glow may be visible from the source depends on the characteristics of vessel/MODU lighting (including height above sea level) and environmental conditions (e.g. cloud cover).

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Impact Assessment

Receptors that have important habitat within a 20 km buffer of the Operational Area were considered for the impact assessment, based on recommendations of the National Light Pollution Guidelines for Wildlife Including Marine Turtles, Seabirds and Migratory Shorebirds (NLPG). The 20 km threshold provides a precautionary limit based on observed effects of sky glow on marine turtle hatchlings, demonstrated to occur at 15–18 km, and fledgling seabirds grounded in response to artificial light 15 km away (Commonwealth of Australia, 2020).

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*: Species 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.

The 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 seabirds. As described in **Section 4.5.2**, the Operational Area overlaps with internesting buffer habitat critical for the survival of the species' for flatback turtles, and BIAs for flatback turtle internesting, whale shark foraging, and wedge-tailed shearwater breeding and foraging. Given the low abundance of fauna expected to occur within the Operational Area, impacts from light emissions are considered to be highly unlikely. As outlined below, internesting adult female turtles are not impacted by artificial light emissions, and it is more relevant to consider separation distances between light sources and nesting habitat critical for turtles — the nesting locations as identified in Table 6 of the marine turtle Recovery Plan (Commonwealth of Australia, 2017). At the closest point, the Operational Area is located ~44 km from the nearest nesting locations for green, flatback and hawksbill turtles in the Montebello Islands.

Marine Turtles – Hatchlings

Turtle hatchlings emerge from the nest and orient towards the sea. After entering the water, hatchlings use a combination of cues (wave direction and currents) to orient and travel into offshore waters. Impacts to the sea-finding behaviour of hatchlings are more common for light sources behind a beach, as lighting offshore will orient emerging hatchlings towards the sea. Artificial light at close distances can also impact hatchling dispersal once they are in the water. Light spill may 'entrap' hatchling swimming behaviour, reducing the success of their seaward dispersion and potentially increasing their exposure to predators via silhouetting (Salmon et al., 1992).

The nearest turtle nesting locations to the Operational Area are at Montebello Islands, about 44 km south-east of the Operational Area, for flatback, green and loggerhead hawksbill turtles. The distance between the most significant light source on the MODU (flare boom) and the edge of visibility, or the visible horizon, was calculated using a manual calculation that takes atmospheric refraction into consideration (Young's method) as expressed by the formula $d = 3.86\sqrt{h}$, where 'd' is the distance to the visible horizon, and 'h' is the light source height in metres. For a flare boom height of 32 m (maximum likely for potential MODUs that could be contracted for the Petroleum Activities Program), the distance to the visible horizon is ~22 km – i.e. anything beyond this distance is below the horizon and direct light would not be visible. Therefore, direct light from project vessels/MODU will not reach any nesting location, but there is the potential for sky glow (particularly from flaring rather than operational lighting) to be visible at the closest nesting locations.

Whilst sky glow from flaring may be visible at the closest nesting beaches in the Montebello Islands (~48 km from the well locations), it is not credible that it would result in any behavioural impact (i.e. not biologically relevant). The light source is located directly offshore in the same direction that emerging hatchlings would be heading in anyway during normal sea-finding behaviour, meaning that no significant misorientation or disorientation would occur.

Since the Operational Area is located >44 km from turtle nesting beaches in the Montebello Islands, the risk of significant numbers of dispersing hatchlings becoming attracted to direct light or sky glow from project vessels/MODU is not considered credible. This is supported by the findings of a desktop lighting impact assessment for the Scarborough Project, conducted by Pendoley Environmental (PENV, 2020). At a range of >44 km, the density of dispersing hatchlings is expected to be low and very few individuals will be at risk of attraction. For any isolated individuals potentially attracted to light spill from project vessels/MODU, following sunrise, any effect of these light sources on hatchlings will be eliminated allowing dispersal behaviour to resume.

Any impacts to hatchling turtles from artificial light will be limited to possible localised behavioural impacts to isolated individual hatchlings offshore, with no lasting effect to the species.

Marine Turtles – Adults

Although individuals undertaking behaviours such as internesting, migration, mating (adults) or foraging (adults and pelagic juveniles) may occur within the Operational Area, marine turtles do not use light cues to guide these behaviours. Furthermore, there is no evidence, published or anecdotal, to suggest that internesting, mating, foraging or migrating turtles are impacted by light from offshore vessels. As such, light emissions from the project vessels/MODU are unlikely to result in displacement of, or behavioural changes to individuals in these life stages (PENV, 2020).

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Artificial lighting may affect where nesting adult turtles emerge onto the beach, the success of nest construction, whether nesting is abandoned, and the seaward return of adults (Salmon et al., 1995a, 1995b; Salmon and Witherington, 1995). Such lighting is typically from residential and industrial development at the coastline, rather than offshore from nesting beaches. The Montebello Islands (about 50 km from the Operational Area) is a known turtle nesting location, however, direct light from the project vessels/MODU will not be visible to nesting adult turtles, but there is the potential for sky glow (particularly from flaring at night) to be visible. However, nesting females are not considered highly vulnerable to disorientation due to artificial light (PENV, 2020) and it is highly unlikely that sky glow from the Petroleum Activities Program could cause disruption to sea-finding behaviour post nesting, particularly as the light source is located directly offshore in the same direction that females would be heading in anyway during normal sea-finding behaviour. Additionally, as described above, flaring from the MODU (if it occurs) will be of very short duration and intensity. As such, project /MODU light sources will not discourage females from nesting, or affect nest site selection, and therefore will not displace females from nesting habitat.

The Operational Area overlaps the internesting BIA and the ‘internesting habitat critical for the survival of the species’ for flatback turtles. Internesting flatback turtles favour depths of <25 m, and foraging flatback turtles have been found to occur in waters shallower than 130 m (Whittock et al., 2016a, 2016b). Given the water depths of the Operational Area (~110-160 m), foraging flatback turtles may occur in the Operational Area but not in significant numbers given their preference for shallower waters. Individual turtles migrating or mating may occur within or adjacent to the Operational Area, marine turtles do not use light cues to guide these behaviours. As such, light emissions from the vessels are unlikely to result in more than short-term, negligible behavioural disturbance to isolated transient individuals with no lasting effect. Short-term light emissions from the MODU/vessels are unlikely to result in displacement of adult turtles from internesting habitat, or important behaviours for nesting adult turtles.

Seabirds and Migratory Shorebirds

Artificial lighting can attract and disorient seabird species resulting in species behavioural changes (e.g. circling light sources or disrupted foraging), injury or mortality near the light source as a result of collision (Longcore and Rich, 2004; Gaston et al., 2014). The Operational Area may be occasionally visited by seabirds and migratory shorebirds, and overlaps a breeding and foraging BIA for the wedge-tailed shearwater. The nearest emergent land that could be used for roosting or nesting habitat is the Montebello Islands (about 50 km from the Operational Area).

The most vulnerable life stages for seabirds and migratory shorebirds are nesting adults or fledglings. Nesting or fledgling seabirds and migratory shorebirds are vulnerable to artificial lighting within 20 km of the nesting location (Commonwealth of Australia, 2020). For shearwater species, fledglings are predominantly impacted by onshore lighting sources, which can override sea finding cues and attract fledglings further inland, preventing them from reaching the sea (Mitkus et al., 2018; Telfer et al., 1987). Artificial light can also impact important behaviour of nesting adults (e.g. adult nest attendance, maintaining nest sites) or confuse shearwater species, resulting in injury or mortality as a result of birds colliding with structures (Cianchetti-Benedetti et al., 2018; Rodriguez et al., 2017). As the Operational Area is about 50 km from the nearest emergent land, impacts to adult nesting or fledgling seabirds and migratory shorebirds are not expected. Artificial light from the Petroleum Activities Program is not predicted to disrupt critical breeding behaviours within important nesting habitat, or displace seabirds from nesting habitat.

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 (Department of Environment, 2015). The risk associated with collision from seabirds and shorebirds attracted to the light is considered to be low, based on the intermittent and localised nature of the activities in the Operational Area, as well as the distance offshore. Impacts are expected to be limited to temporary behavioural disturbance to isolated individuals, and is not expected to disrupt important migration patterns of migratory seabirds.

Foraging adult seabirds may occur within the Operational Area. Foraging adult seabirds, including shearwaters, are less susceptible to impacts from artificial light than fledglings or nesting adult seabirds. However, they are still vulnerable as artificial light can interact with offshore foraging behaviour which may occur during the day or night.

Foraging adult wedge-tailed shearwaters may be attracted to sources of light emissions to feed on fish drawn to the light, or may be attracted to vessel light during periods of low visibility (Catry et al., 2009; Whittow 1997). During the breeding period at the Muiron Islands off Exmouth Gulf (from around August to April, peak November), adult wedge-tailed shearwaters were observed taking a combination of short (1–4 days) or long (6–30 days) foraging trips from the Muiron Islands, travelling over large areas across the north west of Australia towards Indonesia (Cannell et al., 2019). During the breeding period, foraging adult wedge-tailed shearwaters were observed travelling up to around 1000 km from the breeding colony (Cannell et al., 2019). Although the breeding and foraging BIA overlapping the Operational Area is defined as the area within around 70-80 km from the Montebello Islands, wedge-tailed shearwaters on the NWS have been observed foraging beyond the breeding and foraging BIA. Based on the large area where foraging is known to occur, the Operational Area does not represent a significant portion of the known foraging area for the wedge-tailed shearwaters. Therefore, impacts to wedge-tailed shearwaters are likely to be limited to localised behavioural disturbance to isolated transient individuals. Artificial lighting from the Petroleum Activities Program is not expected to significantly impact foraging or displace seabird species from important foraging habitat.

Other Marine Fauna

Lighting from ROV or project vessel/MODU activities during the Petroleum Activities Program may result in the localised aggregation of fish around the ROV or below the vessel/MODU. These aggregations of fish due to light are considered localised and temporary. Any long-term changes to fish species composition or abundance is considered

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highly unlikely. Any localised impacts to marine fish are not expected to impact on any commercial fishers in the area. Krill or plankton may also aggregate around the source of light. These aggregations of fish, krill or plankton would be confined to a small area and would only occur when the ROV is in use. Based on the short duration and localised nature of the Petroleum Activities Program, these aggregations are not expected to attract either pygmy blue whales or humpback whales. Transient individual whale sharks have been recorded feeding on these plankton aggregations, but lighting from ROV or support vessel/MODU activities is not expected to have any negative impacts on whale shark behaviour. No significant cumulative impacts over the life of the Petroleum Activities Program or in relation to other operations and activities in the region (e.g. JDP2 or Wheatstone) are expected.
Summary of Potential Impacts to Environmental Value(s)
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)***[18]	***Benefit/Reduction in Impact***	***Proportionality***	***Control Adopted***
Legislation, Codes and Standards				
No additional controls identified.				
Good Practice				
Where activities overlap a wedge-tailed shearwater BIA and will occur during the breeding period (August–April) the following measures will be implemented, consistent with the NLPG (2020): • extinguish outdoor/deck lights not necessary for safety and/or navigation at night • use available block-out blinds on portholes and windows not necessary for safety and/or navigation at night • manage seabird landings appropriately and record interactions • minimise flaring.	F: Yes, however a minimum level of lighting is required on the MODU and vessels for safety. CS: Minimal.	Negligible benefit in impact reduction for nesting adult seabirds or fledging seabirds as nearest potential nesting site is not predicted to be impacted by light. Potential for slight reduction in impact to individual foraging and migrating seabirds that may pass through the Operational Area, as identified in the NLPG.	Potential benefits outweigh the cost/sacrifice	Yes **C 10.1**

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1 Qualitative measure

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Demonstration of ALARP				
Control Considered	***Control Feasibility (F) and Cost/Sacrifice (CS)***[18]	***Benefit/Reduction in Impact***	***Proportionality***	***Control Adopted***
Professional Judgement – Eliminate				
Restrict the Petroleum Activities Program to daylight hours, eliminating the need for external work lights.	F: No. Components of the Petroleum Activities Program cannot safely be completed within a 12-hour day shift. As such, the need for external lighting cannot safely be eliminated. CS: Not considered – control not feasible	Not considered – control not feasible	Not considered – control not feasible	No
Vary the timing of the Petroleum Activities Program to avoid peak turtle nesting periods (December to February).	F: Yes. Avoidance of turtle nesting periods is technically feasible, although is not considered to be practicable. CS: Not considered – control not feasible.	Negligible or no reduction consequence given the distance of the nesting areas to the Operational Area.	Grossly disproportionate. Implementation of the control requires considerable cost sacrifice for minimal environmental benefit.	No
Vary the timing of the Petroleum Activities Program to avoid peak breeding and migration periods for seabirds and migratory shorebirds.	F: No. The peak breeding and migration periods of seabirds and migratory shorebirds that may occur within the Operational Area spans all seasons. CS: Significant cost and schedule impacts due to delays in securing vessels/MODU for specific timeframes.	Not considered, control not feasible.	Not considered, control not feasible.	No
Do not flare.	F: No. Flaring is the only feasible way to manage the reservoir fluids brought to surface and achieve the well objectives. CS: Not considered, control not feasible.	Not considered, control not feasible.	Not considered, control not feasible.	No
Professional Judgement – Substitute				
Substitute external lighting with light sources designed to minimise impacts to seabirds, shorebirds and marine turtles: • use flashing/ intermittent lights instead of fixed beam • use motion sensors to turn lights on only when needed • use luminaires with spectral content	F: Yes. Replacement of external lighting with lighting appropriate for turtles and seabirds is technically feasible, although is not considered to be practicable. CS: Significant cost sacrifice. The retrofitting of all external lighting on the MODU, etc., would result in considerable cost and time expenditure. Considerable logistical effort to source sufficient	Given the potential impacts to turtles, nesting seabirds and fledglings during this activity are insignificant, implementation of this control would not result in a reduction in consequence. Potential for minor reduction in impact to individual foraging seabirds that may transit the Operational Area, as outlined in the NLPG.	Grossly disproportionate. Implementation of the control requires considerable cost sacrifice for minimal environmental benefit. The cost/sacrifice outweighs the benefit gained.	No

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Demonstration of ALARP

Control Considered	*Control Feasibility (F) and Cost/Sacrifice (CS)*[18]	*Benefit/Reduction in Impact*	*Proportionality*	*Control Adopted*
appropriate for the species present • avoid high intensity light of any colour.	inventory of the range of light types onboard the MODU.			

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, **Section 2.6.1**), Woodside considers the potential impacts from routine light emissions from the MODU and 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 are considered ALARP.

Demonstration of Acceptability

Acceptability Statement

The impact assessment has determined that, given the adopted controls, routine light emissions from external lighting on the MODU and project vessels may result in localised and temporary behavioural disturbance to species within the Operational Area, with no lasting effect (<1 month). BIAs within the Operational Area include the flatback turtle internesting, whale shark foraging, and wedge-tailed shearwater breeding and foraging areas. Regard has been given to relevant conservation advice and wildlife conservation plans during the assessment of potential impacts and the NLPG were taken into consideration during the impact evaluation. The Petroleum Activities Program is not considered to be inconsistent with the overall recovery objectives and actions of these recovery plans and conservation advice (**Section 6.8**).

On the basis of the environmental impact assessment outcomes and Woodside's criteria for acceptability outlined in **Section 2.7.2**, Woodside considers this an acceptable level of impact.

Environmental Performance Outcomes, Standards and Measurement Criteria

Outcomes	*Controls*	*Standards*	*Measurement Criteria*
EPO 10 Minimise impacts to wedge-tailed shearwaters from light emissions.	**C 10.1** Where activities overlap a wedge-tailed shearwater BIA and will occur during the breeding period (August–April) the following measures will be implemented, consistent with the NLPG (2020): • extinguish outdoor/deck lights not necessary for safety and/or navigation at night • use available block-out blinds on portholes and windows not necessary for safety and/or navigation at night • manage seabird landings appropriately and record interactions • minimise flaring.	**PS 10.1.1** Pre-mobilisation MODU/vessel inspections will identify vessel operational controls to minimise light to safety and/or navigation requirements.	**MC 10.1.1** Pre-mobilisation MODU/vessel inspection records include identification of vessel operational controls to minimise light to safety and/or navigation requirements.
		PS 10.1.2 MODU/Project vessels will have a procedure, with the requirement to use available block-out blinds on portholes and windows not necessary for safety and/or navigation when operating at night.	**MC 10.1.2** MODU/vessel contractor procedures include requirement to use available block-out blinds not necessary for safety and/or navigation when operating at night.
		PS 10.1.3 Record observed bird trappings and collisions and implement care and release steps.	**MC 10.1.3** Records maintained of bird interactions and any care and release steps implemented, as required.

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6.7 Unplanned Activities (Accidents, Incidents, Emergency Situations)

6.7.1 Quantitative Spill Risk Assessment Methodology

Quantitative hydrocarbon spill modelling was undertaken by RPS, on behalf of Woodside, using a three-dimensional (3D) hydrocarbon spill trajectory and weathering model, SIMAP (Spill Impact Mapping and Analysis Program), which is designed to simulate the transport, spreading and weathering of specific hydrocarbon types under the influence of changing meteorological and oceanographic forces.

A stochastic modelling scheme was followed in this study, whereby SIMAP was applied to repeatedly simulate the defined credible spill scenarios using different samples of current and wind data. These data samples were selected randomly from an historic time-series of wind and current data representative of the study area. 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 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.

During each simulation, the SIMAP model records the location (by latitude, longitude and depth) of each of the particles (representing a given mass of hydrocarbons) on or in the water column, at regular time steps. For any particles that contact a shoreline, the model records the accumulation of hydrocarbon mass that arrives on each section of shoreline over time, less any mass that is lost to evaporation and/or subsequent removal by current and wind forces.

The collective records from all simulations are then analysed by dividing the study region into a 3D grid. For surface hydrocarbons (floating oil), the sum of the mass in all hydrocarbon particles located within a grid cell, divided by the area of the cell, provides hydrocarbon concentration estimates in that grid cell at each model output time interval. For entrained and dissolved aromatic hydrocarbon particles, concentrations are calculated at each time step by summing the mass of particles within a grid cell and dividing by the volume of the grid cell. The process is also subject to the application of spreading filters that represent the expected mass distribution of each distinct particle. The concentrations of hydrocarbons calculated for each grid cell, at each time step, are then analysed to determine whether concentration estimates exceed defined threshold concentrations.

All hydrocarbon spill modelling assessments undertaken 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. This assessment is done by post-processing the sensitivity test results and analysing time-series of median and maximum concentrations in the water and on the surface.

6.7.1.1 Hydrocarbon Characteristics

As part of the risk identification process, Woodside identified the range of credible hydrocarbon spill scenarios that may occur from the Petroleum Activities Program. These scenarios are considered in the risk assessments of accidental hydrocarbon spill scenarios (**Sections 6.7.2** to **6.7.5**), and include:

- uncontrolled release to the marine environment during permanent plugging activities resulting in ~14,113 m³ of Balnaves crude released for 67 days from the BAL-5H production well location

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within the Operational Area. This includes five days of surface release and 62 days of subsea release. This is considered the worst case scenario from a loss of well integrity

- uncontrolled subsea release to the marine environment during permanent plugging activities from an oil production well following accidental damage to, or removal of, the subsea Xmas tree due to MODU anchor drag within the Operational Area
- a vessel collision resulting in about 500 m^3 of marine diesel instantaneously released
- a bunkering incident scenario resulting in about 8 m^3 of diesel instantaneously released

Woodside has undertaken physical and ecotoxicology testing on Balnaves crude, which is the hydrocarbon that can credibly be released from a loss of well containment event. The physical characteristics of Balnaves crude, along with marine diesel, as used in the hydrocarbon spill modelling studies, are provided in **Table 6-6**.

Table 6-6: Hydrocarbon characteristics

Hydrocarbon Type	Initial Density (g/cm^3)	Viscosity (cP)	Component BP (°C)	Volatiles <180 °C	Semi volatiles 180–265 °C	Low Volatility (%) 265–380 °C	Residual (%) >380 °C	Aromatic (%) of whole oil <380 °C BP
				Non-Persistent			Persistent	
Balnaves crude	0.7843 @ 15 °C	1.879 @ 40 °C	% of total	47.7	20.7	23.2	8.4	4.4
			% aromatics	2.8	1.6	-	-	-
Marine diesel	0.829 @ 25 °C	4.0 @ 25 °C	% of total	6.0	34.6	54.4	5.0	3.0
			% aromatics	1.8	1.0	0.2	-	-

6.7.1.2 Environment that May Be Affected and Hydrocarbon Contact Thresholds

The outputs of the quantitative hydrocarbon spill modelling were used to assess the environmental consequence, if a credible hydrocarbon spill scenario occurred, in terms of 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.

As the weathering of different fates of hydrocarbons (surface, entrained and dissolved) differs due to the influence of the metocean transport mechanisms, the EMBA combines the potential spatial extent of the different fates. The EMBA also includes areas that are predicted to experience shoreline 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, and the EMBA represents the total extent of all the locations where hydrocarbon thresholds could be exceeded from all modelling runs. Furthermore, as the weathering of different fates of hydrocarbons (surface, entrained and dissolved) differs due to the influence of the metocean transport mechanism, a different EMBA is presented for each fate. These EMBA together define the spatial extent for the existing environment, which is described in **Section 4**. Hydrocarbon contact below the defined thresholds may occur outside the EMBA and socio-cultural EMBA; however, the effects of these low exposure values will be limited to temporary exceedance of water quality triggers. The area within which this may occur in the event of a worst-case credible spill is presented in **Appendix D: Figure 5-1**.

The spill modelling outputs are presented as areas that meet threshold concentrations for surface, entrained and dissolved hydrocarbons for the modelled scenarios. Surface spill concentrations are expressed as grams per square metre (g/m^2), with entrained and dissolved aromatic hydrocarbon concentrations expressed as parts per billion (ppb). A conservative approach to selecting thresholds was taken by adopting the guideline impact thresholds (NOPSEMA, 2019) for floating, entrained,

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dissolved and accumulated hydrocarbons. Hydrocarbon thresholds are presented in **Table 6-7** and described in the following subsections.

Table 6-7: Summary of thresholds applied to the quantitative hydrocarbon spill risk modelling results

Hydrocarbon Type	EMBA				Socio-cultural EMBA
	Surface Hydrocarbon (g/m^2)	Entrained hydrocarbon (ppb)	Dissolved aromatic hydrocarbon (ppb)	Accumulated hydrocarbons (g/m^2)	Surface Hydrocarbon (g/m^2)
Crude	10	100	50	100	1
Diesel	10	100	50	100	1

Surface Hydrocarbon Threshold Concentrations

The spill modelling outputs defined the EMBA for surface hydrocarbon spills (contact on surface waters) using the ≥10 g/m^2 threshold (dull metallic colours) based on the relationship between film thickness and appearance (Bonn Agreement, 2015) (**Table 6-8**). This threshold concentration, expressed in terms of g/m^2, 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 (e.g. 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/m^2 (French et al., 1999; Koops et al., 2004; NOAA, 1996; French-McCay, 2018). Potential impacts of surface slick concentrations in this range for floating hydrocarbons may include harm to seabirds through ingestion from preening of contaminated feathers, or the loss of the thermal protection of their feathers. The 10 g/m^2 threshold is the reported level of oiling to instigate impacts to seabirds, and is also applied to other wildlife, although 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 from the most vulnerable wildlife such as seabirds. Due to weathering processes, surface hydrocarbons have a lower toxicity due to changes in their composition over time. Potential impacts to shoreline sensitive receptors may be markedly reduced in instances where there is extended duration until the slick contacts the shoreline.

Woodside recognises that hydrocarbons may be visible at low concentrations of approximately 1 g/m^2. Therefore, the threshold for visible surface oil (1 g/m^2) was 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 6-7**, 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.

The boundaries of the two EMBAs may differ due to the different thresholds, hydrodynamics and weathering of the released hydrocarbons.

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Table 6-8: The Bonn Agreement oil appearance code

Appearance (following Bonn visibility descriptors)	Mass per area (g/m^2)	Thickness (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

Dissolved Marine Diesel Hydrocarbon Threshold Concentration

Dissolved hydrocarbons present a narcotic effect resulting from uptake into the tissues of marine organisms. This effect is additive, increasing with exposure concentration or with time of exposure (French-McCay, 2002; NRC, 2005). The dissolved aromatic threshold of 50 ppb has been selected as a medium level threshold to approximate the potential toxic effects, particularly sublethal effects to sensitive species, as consistent with the NOPSEMA Oil Spill Modelling Guidance Bulletin (NOPSEMA, 2019).

Entrained Marine Diesel Hydrocarbon Threshold Concentration

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 entrained threshold has been selected to be consistent with the NOPSEMA Oil Spill Modelling Guidance Bulletin (NOPSEMA, 2019). An entrained threshold of 100 ppb is considered to be appropriate given the oil characteristics for informing potential impacts to receptors.

Accumulated Hydrocarbon Threshold Concentrations

Owens and Sergy (1994) define accumulated hydrocarbon <100 g/m^2 to have an appearance of a stain on shorelines. French-McCay (2009) defines accumulated hydrocarbons ≥100 g/m^2 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/m^2 has therefore been adopted to define the EMBA for both a condensate and diesel spill. Further, any ecological impacts at the accumulated thresholds concentration EMBA may also result in socio-cultural impacts.

6.7.1.3 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 defined with reference to the low exposure entrained value of 10 ppb detailed in NOPSEMA Bulletin #1 Oil Spill Modelling (2019). This low exposure threshold is based on the potential for exceeding water quality triggers.

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.

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6.7.2 Unplanned Hydrocarbon Release: Loss of Well Containment (Loss of Well Control)

Context		
Permanent Plugging Activities– **Section 3.10**	Physical Environment – **Section 4.4** Biological Environment – **Section 4.5** Socioeconomic and Cultural – **Section 4.6**	Stakeholder Consultation – **Section 5**

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	Socioeconomic	Decision Type	Consequence / Impact	Likelihood	Risk Rating	ALARP Tools	Acceptability	Outcome
Loss of hydrocarbons to marine environment due to loss of well containment	X	X	X	X	X	X	X	B	B	1	M	LCS GP PJ RBA CV SV	Acceptable	EPO 11

Description of Source of Risk

Background

Woodside has identified a well blowout as the scenario with the worst-case credible environmental outcome as a result of loss of well containment. A loss of well containment is an uncontrolled release of reservoir hydrocarbon or other well fluids to the environment. A blowout is an incident where formation fluid flows out of the well or between formation layers after all the predefined technical well barriers (e.g. the BOP) or activation of the same has failed.

Industry Experience

A risk assessment by AMSA of oil spills in Australian ports and waters (Det Norske Veritas 2011) concluded that:

- overall national exceedance frequency for oil spills from offshore drilling in Australia is 0.033 for spills > 1 tonne/year decreasing to 0.008 for spills > 100 tonnes/year
- probability of a blow-out from a well intervention is 1 x 10^{-4} (0.0001, or 0.01%), considerably lower than drilling activities (International Association of Oil and Gas Producers 2010).

Woodside has a good history of implementing industry standard practice in well design and construction. In the company's 60 year history, it has not experienced any well containment events that have resulted in significant releases or significant environmental impacts.

Therefore, in accordance with the Woodside Risk Matrix, a loss of well containment and resulting blowout event corresponds to a 'highly unlikely' event as it has occurred many times in the industry, but not in the Company.

Credible Scenario – Loss of Well Containment

The credible scenario to be considered during permanent plugging of the Balnaves wells is an uncontrolled release to environment.

Note: Other credible loss of well containment scenarios not associated with permanent plugging of wells are considered in **Section 6.7.3**.

Quantitative Hydrocarbon Spill Modelling – Loss of Well Containment

Spill modelling was undertaken by RPS, on behalf of Woodside, to determine the fate of hydrocarbon released from the loss of well containment scenario, based on the assumptions in **Table 6-9**. The modelled release rate provided assumes the worst case scenario for the largest oil volume release. BAL-5H was chosen for simulation as it had the highest oil production and highest reservoir pressure at time of field shut-in, and therefore represents the worst case scenario. Modelling considered metocean conditions throughout the year; this was done to inform the determination of consequence of loss of well control during intervention at any time of the year.

Table 6-9: Summary of modelled credible scenario – loss of well containment

Parameter	***Loss of well containment***[19]
Total discharge at surface	5 days 1848 m^3
Total discharge at Seabed	62 days 12,262 m^3
Water Depth	135.9 m
Fluid	Balnaves Crude

Hydrocarbon Characteristics

The characteristics of the Balnaves Crude oil are presented in **Table 6-6**.

Balnaves crude is a mixture of volatile and persistent hydrocarbons with high proportions of volatile and semi-volatile components. In favourable evaporation conditions, about 69% of the oil is predicted to evaporate within the first 24 hours. Under calm conditions, the majority of the remaining oil on the water surface will weather at a slower rate due to being comprised of the longer-chain compounds with higher boiling points. Evaporation of the residual compounds will slow significantly, and they will then be subject to more gradual decay through biological and photochemical processes.

Under variable-wind conditions, where the winds are of greater strength on average, entrainment of Balnaves Crude into the water column is predicted to increase. Approximately 24 hours after the spill, around 37% of the oil mass is forecast to have entrained and a further 61% is forecast to have evaporated, leaving only a small proportion of the oil floating on the water surface (<1%) (Figure 6-2). The residual compounds will tend to remain entrained beneath the surface under conditions that generate wind waves (approximately >6 m/s).

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[19] The discharge volumes in this table are predicted using reservoir modelling software packages that take into account a number of factors (well design, reservoir properties and environmental conditions (e.g. water depth, temperature and pressure) to provide a production profile over the oil spill modelling period.

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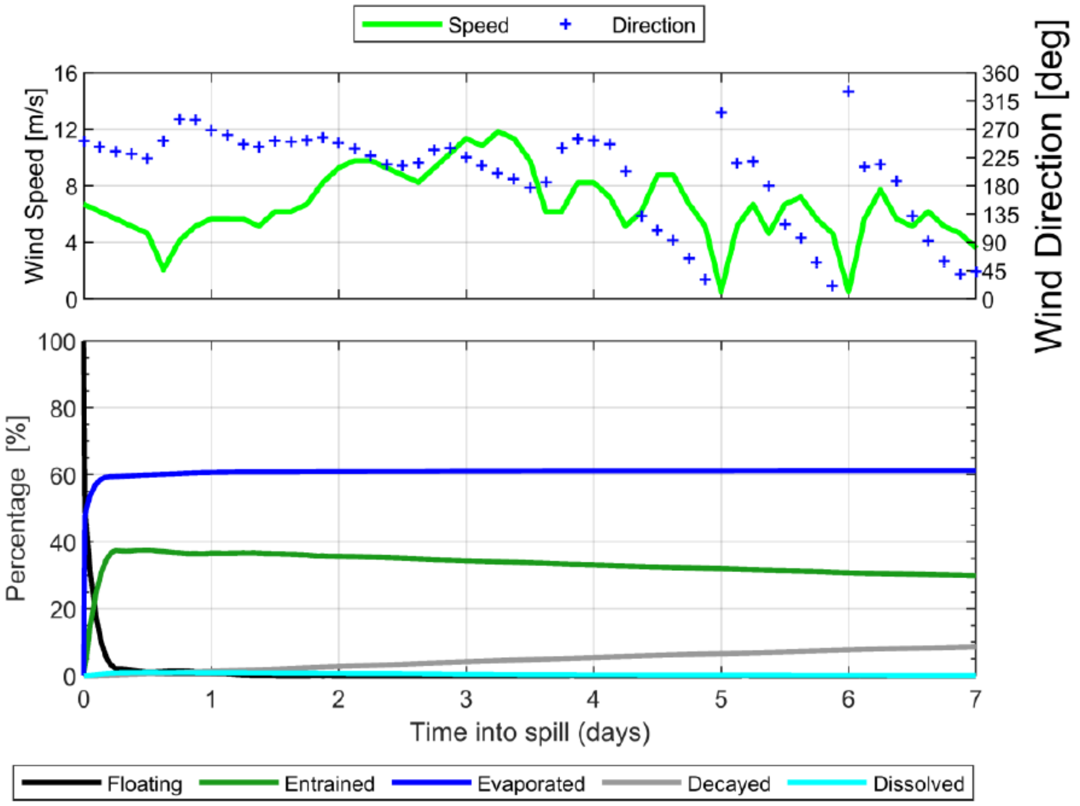

Figure 6-2: Proportional mass balance plot representing the weathering of Balnaves crude spilled onto the water surface as a one-off release (50 m^3 over one hour) and subject to variable wind at 27 °C water temperature and 25 °C air temperature

Subsea Plume dynamics

The well blowout surface/subsea release that has been modelled forecasts the size of the hydrocarbon droplets that would be released from the well as determined by the OILMAP-Deep model. **Table 6-10** shows a summary of the results of the OILMAP Deep modelling for the well blowout.

Table 6-10: Near-field blowout model parameters for loss of well containment

OILMAP	Parameter	Value
Inputs	Release Depth (m BMSL)	135.9
	Oil Density (g/cm^3) (at 15 °C)	0.7843
	Oil Viscosity (cP (at 40 °C)	1.879
	Oil Temperature (°C)	85
	Gas:Oil Ratio (scf/bbl)	1590 - 1720
	Oil Flow Rate (bbl/hr) [m^3/hr]	34 - 96 [5 - 15]
	Diameter of Hole (m) [in]	0.14 [5.5]
Outputs	Plume Diameter (m)	16.6 – 48.9
	Plume Height (m ASB)	93.8 – 135.3
	Plume Initial Rise Velocity (m/s)	1.63 – 2.41
	Plume Terminal Rise Velocity (m/s)	0.04 – 1.28
Predicted Oil Droplet Size Distribution	20% droplets size (µm)	266.5 (week 1) – 849.6 (week 10)
	20% droplets size (µm)	624.2 (week 1) – 1989.8 (week 10)

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	20% droplets size (µm)	818.4 (week 1) – 2609.1 (week 10)
	20% droplets size (µm)	1079.1 (week 1) – 3440.2 (week 10)
	20% droplets size (µm)	1542.4 (week 1) – 4917.0 (week 10)

The results of the OILMAP simulation predict that the discharge will initially generate a cone of rising gas that will entrain the oil droplets and ambient sea water to the sea surface. After the first four weeks the predicted reduction in seabed release rate is expected to lead to the plume to become trapped further below the surface, eventually trapping at depth of around 40 m. The mixed plume is initially forecast to jet towards the water surface with a vertical velocity of around 2.4 m/s, gradually slowing and increasing in plume diameter as more ambient water is entrained. The diameter of the central cone of rising water and oil at the point of surfacing is predicted to be range from approximately 15 m to 50 m.

Given the discharge velocity and turbulence generated by the expanding gas plume, the release is predicted to generate large droplet sizes ranging from 266 µm to 4,917 µm. These droplets will be subject to mixing due to turbulence generated by the lateral displacement of the rising plume. Once reaching the end of the plume phase the oil droplets are expected to rise to the surface relatively quickly due to their strong buoyancy relative to other mixing processes. The results suggest that beyond the immediate vicinity of the blowout most of the released hydrocarbons will be present in the upper layers of the ocean, with the potential for oil to form floating slicks under sufficiently calm local wind conditions.

Consequence Assessment

Potential impacts to environmental values

EMBA

Quantitative hydrocarbon spill modelling results are shown in **Table 6-11** and have been used to define the EMBA (**Sections 4.1** and **6.7.1.2**).

Surface Hydrocarbons

Quantitative hydrocarbon spill modelling results for surface hydrocarbons are shown in **Figure 4-1**. In the event of the loss of well containment scenario occurring, surface hydrocarbons at or above 1 g/m^2 are forecast to potentially occur up to 58 km from the release site and are not predicted to contact any shoreline receptors. The oil slick is forecast to drift in all directions, reflecting the competing influence of both surface currents and winds. The Montebello AMP is predicted to receive floating oil concentrations greater than 1 g/m^2 with a probability of 49% (**Table 6-11**). At the surface threshold of 10 g/m^2, floating oil is forecast to potentially occur up to 11 km from the release site is not predicted to contact any sensitive receptors.

Entrained Hydrocarbons

Quantitative hydrocarbon spill modelling results for entrained hydrocarbons are shown in **Figure 4-1**. At the entrained threshold of 100 ppb, entrained oil is forecast to potentially occur up to 319 km from the release site, predominantly in a south-west direction. Concentrations above 100 ppb are not predicted to exceed depths of around 20 m beyond the immediate source. The probability of contact by entrained oil at concentrations above 100 ppb is predicted to be 90% at Montebello AMP and <17% at other locations including Gascoyne AMP, Ningaloo AMP and Ningaloo coast, Barrow Island, Pilbara Islands – South, Muiron Islands and Rankin Bank (**Table 6-11**).

Dissolved Hydrocarbons

Quantitative hydrocarbon spill modelling results for dissolved hydrocarbons are shown in **Figure 4-1**. At the dissolved threshold of 50 ppb, dissolved aromatic hydrocarbons are forecast to potentially occur up to 49 km from the release site and is predicted to contact Montebello AMP at a probability of 5%. No other sensitive receptors are predicted to be contacted by dissolved hydrocarbons. Concentrations above 50 ppb are not predicted to exceed depths of around 80 m beyond the immediate source.

Accumulated Hydrocarbons

Quantitative hydrocarbon spill modelling results for maximum local accumulated hydrocarbon concentrations indicated that no shoreline locations have potential to experience shoreline accumulation above the ecological threshold concentration of 100 g/m^2 (**Table 6-11**). The Muiron Islands are predicted to be contacted by shoreline oil concentrations at or greater than the socio-cultural threshold of 10 g/m^2 with a probability of 13%, as well as several other receptors with probabilities of less than 8% (**Table 6-11**). The worst-case accumulated concentration is predicted as 51 g/m^2 at the Ningaloo Coast.

Summary of Potential impacts to environmental values

Table 6-11 presents the full extent of the EMBA, i.e. the sensitive receptors and their locations that may be exposed to hydrocarbons (surface, entrained and dissolved) at or above the set threshold concentrations in the unlikely event of a major hydrocarbon release from a loss of well containment during the Petroleum Activities Program. Details of these receptors are outlined in **Section 4**. The potential biological and ecological impacts of an unplanned hydrocarbon

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Consequence Assessment
release as a result of a loss of well containment during the Petroleum Activities Program are presented in the following sections.

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Table 6-11: Key receptor locations and sensitivities potentially contacted above impact thresholds by the loss of well containment scenario with summary hydrocarbon spill contact (table cell values correspond to probability of contact [%])

Environmental setting	Location / name	Environmental, Social, Cultural, Heritage and Economic Aspects presented as per the Environmental Risk Definitions (Woodside's Risk Management Procedure [WM0000PG10055394])																													Probability of hydrocarbon contact and fate (%)					
		Physical		Biological																						Socioeconomic and Cultural					Note: the probability is based on stochastic modelling of 100 hypothetical worst-case spills under a variety of weather and metocean conditions					
		Water Quality	Sediment Quality	Marine Primary Producers			Other Communities / Habitats								Protected Species									Other Species							Socio-cultural EMBA		Ecological EMBA			
		Open water – (pristine)	Marine Sediment – (pristine)	Coral reef	Seagrass beds / Macroalgae	Mangroves	Spawning/nursery areas	Open water – Productivity/upwelling	Non-biogenic 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 (foraging and internesting areas and significant nesting beaches)	Sea snakes	Whale sharks	Sharks and rays	Seabirds and/or migratory shorebirds	Pelagic fish populations	Resident /Demersal Fish	Fisheries – commercial	Fisheries – traditional	Tourism and Recreation	Protected Areas / Heritage – European and Indigenous / Underwater Cultural Heritage	Offshore Oil and Gas Infrastructure (topside and subsea)	Surface hydrocarbon (1-10 g/m^2)	Accumulated hydrocarbons (10–100 g/m^2)	Surface hydrocarbon (≥10 g/m^2)	Entrained hydrocarbon (≥100 ppb)	Dissolved aromatic hydrocarbon (≥50 ppb)	Accumulated hydrocarbons (>100 g/m^2)
Offshore[20]	Montebello AMP	✓	✓	✓			✓	✓							✓	✓			✓	✓	✓	✓	✓	✓	✓	✓		✓	✓		-	-	-	90	5	-
	Ningaloo AMP	✓	✓					✓		✓					✓	✓			✓		✓	✓	✓	✓	✓	✓		✓	✓		-	-	-	16	-	-
	Gascoyne AMP	✓	✓												✓	✓			✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	-	-	-	13	-	-
	Rankin Bank	✓	✓	✓			✓	✓		✓						✓				✓		✓		✓	✓	✓		✓			2	-	-	-	-	-
Islands	Montebello Islands (including State Marine Park)	✓	✓	✓	✓	✓	✓	✓				✓		✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓		✓	✓		-	8		4	-	-
	Barrow Island (including State Nature Reserves, State Marine Park and Marine Management Area)	✓	✓	✓	✓		✓	✓				✓		✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	-	8	-	11	-	-
	Pilbara Islands – Southern Island Group (Serrurier, Thevenard and Bessieres Islands – State Nature Reserves)	✓	✓		✓		✓		✓			✓		✓		✓	✓		✓	✓		✓	✓	✓	✓	✓		✓	✓		-	5	-	4	-	-
	Muiron Islands (WHA, State Marine Park)	✓	✓	✓	✓		✓	✓		✓		✓		✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓			✓	✓		-	13	-	13	-	-
Mainland (nearshore waters)	Ningaloo Coast (North/North West Cape, Middle and South) (WHA, and State Marine Park)	✓	✓	✓	✓	✓	✓	✓		✓		✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓		✓	✓		-	8	-	17	-	-

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[20] Note: hydrocarbons cannot accumulate on open ocean, submerged receptors, or receptors not fully emergent.

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<table>
<tr><th colspan="2">Summary of Potential Impacts to Environmental Values(s)</th></tr>
<tr><td colspan="2"><i>Summary of Potential Impacts to protected species</i></td></tr>
<tr><td><i>Setting</i></td><td><i>Receptor Group</i></td></tr>
<tr><td><i>Offshore</i></td><td><i>Cetaceans</i>
A range of cetaceans were identified as potentially occurring within the Operational Area and wider EMBA (Section 4.5.2.3). In the event of a loss of well containment, surface, entrained, and dissolved hydrocarbons exceeding environmental impact threshold concentrations may drift across habitat for cetacean species. Migratory routes and BIAs of cetaceans considered to be MNES may be affected, including humpback whales and pygmy blue whales (northbound and southbound migrations).
Cetaceans 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 (Deepwater Horizon Natural Resource Damage Assessment Trustees [DHNRDT] 2016). This may result in the irritation of sensitive membranes such as the eyes, mouth, digestive and respiratory tracts, and organs. Other potential impacts include impairment of the immune system, neurological damage (Helm et al. 2015), reproductive failure, other adverse health effects (e.g. lung disease, poor body condition), and mortality (DHNRDT 2016). Physical contact with hydrocarbons is likely to have biological consequences for these species. Given cetaceans maintain thick skin and blubber, external exposure to hydrocarbons may result in irritation to skin and eyes. Hydrocarbons may also be ingested, particularly by baleen whales (e.g. pygmy blue whales and humpback whales), which feed by filtering large volumes of water.
Geraci (1988) has identified behavioural disturbance through avoidance of spilled hydrocarbons in several species of cetacean, suggesting that cetaceans have the ability to detect 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 Deepwater Horizon spill, cetaceans were routinely seen swimming in surface slicks offshore and nearshore (Aichinger Dias et al. 2017). In a review of the impacts of large scale hydrocarbon spills on cetaceans, it was found that exposure to oil from the Deepwater Horizon resulted in increased mortality to cetaceans in the Gulf of Mexico (DHNRDT 2016), and long-term population level impacts to killer whales were linked to the Exxon Valdez tanker spill (Matkin et al. 2008).
Cetacean populations that are resident within the EMBA may be susceptible to impacts from spilled hydrocarbons if they interact with an area affected by a spill. Such species are more likely to occupy coastal waters (refer to the Mainland and Islands section below for additional information). Suitable habitat for oceanic toothed whales (e.g. sperm whales) and dolphins is broadly distributed throughout the region and as such, impacts are unlikely to affect an entire population. Other species identified in Section 4.5.2.3 may also have possible transient interactions with the EMBA (refer to Table 6-11 for the list of receptor locations for cetaceans).
Pygmy blue whales and humpback whales are known to migrate seasonally through the wider EMBA; however, the migration BIAs in the region for both species do not overlap the Operational Area. A major spill in May to November would coincide with humpback whale migration through the waters off the Pilbara and North West Cape (Figure 4-8). A major spill in April–August or October would coincide with pygmy blue whale migration (Figure 4-7). Both pygmy blue and humpback whales are baleen whales, so are most likely to be significantly impacted by toxic effects when feeding. However, feeding during migrations is low level and opportunistic, with most feeding for both species occurring in the Southern Ocean.
Fresh hydrocarbons (i.e. typically in the vicinity of the release location) may have a higher potential to cause toxic effects when ingested, while weathered hydrocarbons are considered to be less likely to result in toxic effects. As such, the risk of ingestion of hydrocarbons is low. Pygmy blue whale and humpback whale migrations are protracted through time and space (i.e. the whole population will not be within the EMBA), and as such, a spill from the loss of well integrity is unlikely to affect an entire population. The humpback whale calving BIA in Camden Sound is not predicted to be contacted by hydrocarbons above threshold concentrations. Entrained hydrocarbons above threshold levels are not predicted to extend into Exmouth Gulf, which is a resting BIA for humpback whales during their southern migration.
Therefore, a worst-case hydrocarbon spill scenario has the potential to result in major long-term impacts to offshore cetacean species, with consequence severity dependent on the actual timing, duration and extent of a spill in relation to species' migratory movements and distributions. Potential impacts to inshore cetaceans and other marine mammals are discussed in the Mainland and Islands (nearshore) impacts discussion below.</td></tr>
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Summary of Potential Impacts to Environmental Values(s)	
	Marine Turtles Adult sea turtles exhibit no avoidance behaviour when they encounter hydrocarbon spills (NOAA 2010). Therefore, contact with surface slicks or entrained hydrocarbon can result in hydrocarbons adhering to body surfaces (Gagnon and Rawson 2010) causing irritation of mucous membranes in the nose, throat and eyes, leading to inflammation and infection (NOAA 2010). Oiling can also irritate and injure skin, which is most evident on pliable areas such as the neck and flippers (Lutcavage et al. 1995). A stress response associated with this exposure includes an increase in the production of white blood cells, and even a short exposure to hydrocarbons may affect the functioning of the salt gland (Lutcavage et al. 1995). Hydrocarbons in surface waters may also impact turtles when they surface to breathe as they may 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 hydrocarbons adhering to body surfaces, causing irritation of mucous membranes in the nose, throat and eyes and leading to inflammation and infection (Gagnon and Rawson 2010). An internesting BIA and habitat critical to the survival of flatback turtles overlaps the Operational Area. However, the Operational Area is unlikely to represent an important habitat for marine turtles as there is an absence of potential nesting or foraging habitat (i.e. no emergent islands, reef habitat or shallow shoals) and the water is deep (~110 m to 160 m). There are significant nesting and foraging sites along the mainland coast and islands of the region, including Dampier Archipelago and the Montebello Islands, and a number of BIAs overlap the EMBA (**Section 4.5.2.2** and **Figure 4-5**). In particular the internesting BIAs and habitat critical to the survival of a species for green, loggerhead and hawksbill turtles extend for ~20 km from known nesting locations, and for ~60 km for flatback turtles. It is noted that permanent plugging activities via the MODU will only be undertaken outside cyclone season (November to April) and will therefore avoid peak turtle nesting season where higher numbers of internesting turtles may be present (refer to **Table 4-14**). However, oil from an ongoing loss of containment could be present during nesting season depending on the timing of a spill. In summary, a worst-case hydrocarbon spill scenario has the potential to result in major long-term impacts to offshore foraging marine turtles, with consequence severity dependent on the actual timing, duration and extent of a spill in relation to species' migratory movements and distributions. Potential impacts to nesting marine turtles are discussed in the Mainland and Islands (nearshore) impacts discussion below.
	Sea snakes Impacts to sea snakes from direct contact with hydrocarbons are likely to result in similar physical effects to those recorded for marine turtles. They may include potential damage to the dermis and irritation to mucus membranes of the eyes, nose and throat (International Tanker Owners Pollution Federation [ITOPF] 2011a). They may also be impacted when they return to the surface to breathe and inhale the toxic vapours associated with the hydrocarbons, resulting in damage to their respiratory system. In general, sea snakes frequent the waters of the continental shelf area around offshore islands and potentially submerged shoals (water depths <100 m; see Submerged Shoals below). It is acknowledged that sea snakes may be present in the Operational Area and are present in the wider EMBA. Their abundance is not expected to be high in the deepwater and offshore environment. Therefore, a worst-case hydrocarbon spill scenario has the potential to result in major long-term impacts to offshore sea snakes, with consequence severity dependent on the duration and extent of a spill in relation to the distribution of sea snakes. Potential impacts to inshore and offshore reef associated sea snakes are discussed in the Submerged Shoals and Banks and Mainland and Islands (nearshore) impacts discussion below.
	Sharks, Sawfish and Rays Hydrocarbon contact may affect whale sharks through ingestion of entrained or dissolved hydrocarbons, particularly if feeding. Whale sharks may transit offshore open waters when migrating to and from Ningaloo Reef, where they aggregate for feeding from March to July (see Mainland and Islands (nearshore waters) below). Whale sharks may carry out opportunistic feeding in offshore waters and the Operational Area. The EMBA overlaps the whale shark foraging BIA identified in **Section 4.5.2.1**, within which whale sharks are seasonally present between April and October (**Section 4.5.2.5**). Impacts to sharks and rays may occur through direct contact with hydrocarbons, or through contamination of the tissues and internal

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Summary of Potential Impacts to Environmental Values(s)

organs, either through direct contact or through 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 via coating of the gills inhibiting gas exchange.

Therefore, a worst-case hydrocarbon spill scenario has the potential to result in major long-term impacts to offshore shark, sawfish and ray species, with consequence severity dependent on the actual timing, duration and extent of a spill in relation to species' migratory movements and distributions. Potential impacts to inshore and offshore reef associated sharks, sawfish and rays are discussed in the Submerged Shoals and Banks and Mainland and Islands (nearshore) impacts discussion below.

Seabirds and/or Migratory Shorebirds

Offshore waters are potential foraging grounds for seabirds associated with the coastal roosting and nesting habitat (e.g. Ningaloo, Muiron Islands and the Barrow/Montebello/Lowendal Island Group). There are confirmed foraging grounds off Ningaloo and the Barrow/Montebello/Lowendal Island Group. Foraging and breeding BIAs for a number of seabirds and migratory shorebirds overlap with the EMBA (**Section 4.5.2.4**):

- the wedge-tailed shearwater (peak use August–April)
- the roseate tern
- the lesser crested tern
- the fairy tern

Seabirds and migratory birds are particularly vulnerable to contact with floating hydrocarbons, which may mat feathers. This may lead to hypothermia from loss of insulation, and to ingestion of hydrocarbons when preening to remove hydrocarbons; both impacts may result in mortality (Hassan and Javed 2011).

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 (AMSA 2013, International Petroleum Industry Environmental Conservation Association [IPIECA] 2004):

- plumage fouling and hypothermia (loss of thermoregulation)
- decreased buoyancy and consequent increased potential to drown
- inability to fly or feed
- anaemia
- pneumonia
- and irritation of eyes, skin, nasal cavities and mouths.

Longer-term exposures may potentially impact seabird populations through loss of reproductive success, malformation of eggs or chicks (AMSA 2013), or mortality of individuals from oiling of feathers or the ingestion of hydrocarbons.

A hydrocarbon spill may result in surface slicks disrupting a significant portion of the foraging habitat for seabirds, including foraging BIAs, which are generally associated with breeding habitats. Seabird distributions are typically concentrated around islands, so hydrocarbons near nesting/roosting areas may result in increased numbers of seabirds being impacted, with many species of seabirds, such as the wedge-tailed shearwater and the various species of tern, foraging relatively close to breeding islands/colonies.

Therefore, a worst-case hydrocarbon spill scenario has the potential to result in major long-term impacts to offshore seabirds and migratory shorebirds, with consequence severity dependent on the actual timing, duration and extent of a spill in relation to species' migratory movements and distributions. Potential impacts to coastal and offshore island associated birds are discussed in the Mainland and Islands (nearshore) impacts discussion below.

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Summary of Potential Impacts to Environmental Values(s)	
Submerged Shoals and Banks	***Marine Turtles*** There is the potential for marine turtles to be present at submerged shoals such as Rankin Bank, which has potential to be contacted by entrained hydrocarbons above the threshold concentration. Rankin Bank may, at times, be foraging habitat for marine turtles, given the coral and filter feeding biota associated with this area. Therefore, a worst-case hydrocarbon spill scenario has the potential to result in major long-term impacts to foraging marine turtles, with consequence severity dependent on the actual timing, duration and extent of a spill in relation to species' migratory movements and distributions. Potential impacts to nesting and internesting marine turtles are discussed in the Mainland and Islands (nearshore) impacts discussion below.
	Sea snakes There is the potential for sea snakes to be present at submerged shoals such as Rankin Bank. The potential impacts of exposure are as discussed previously in Offshore – Sea snakes. Sea snake species in Australia generally show strong habitat preferences (Heatwole and Cogger 1993); species that have preferred habitats associated with submerged shoals may be disproportionately affected by a hydrocarbon spill affecting such habitat. Therefore, a worst-case hydrocarbon spill scenario has the potential to result in major long-term impacts to offshore reef associated sea snakes, with consequence severity dependent on the duration and extent of a spill in relation to the distribution of sea snakes. Potential impacts to inshore sea snakes are discussed in the Mainland and Islands (nearshore) impacts discussion below.
	Sharks, Sawfish and Rays There is the potential for resident shark and ray populations to be impacted directly from hydrocarbon contact, or indirectly through contaminated prey or loss of habitat. Spill model results indicate Rankin Bank is predicted to be contacted by entrained hydrocarbons above threshold concentrations). Shark and ray species that have associations with submerged shoals may be more susceptible to a reduction in habitat quality resulting from a hydrocarbon spill. Therefore, a worst-case hydrocarbon spill scenario has the potential to result in major long-term impacts to offshore reef associated shark, sawfish and ray species, with consequence severity dependent on the actual timing, duration and extent of a spill in relation to species' migratory movements and distributions. Potential impacts to inshore associated sharks, sawfish and rays are discussed in the Mainland and Islands (nearshore) impacts discussion below.
Mainland and Islands (Nearshore Waters)	***All Species*** The information provided on protected species in this section is in addition to that provided in the preceding Offshore and Submerged Banks and Shoals sections. Refer to these preceding sections for additional discussion of protected species.
	Cetaceans and Dugongs In addition to a number of whale species that may occur in nearshore waters (refer to **Section 4.5.2.3** for the full list of EPBC listed cetacean species identified by the PMST with potential to occur within the EMBA), coastal populations of small cetaceans and dugongs are known to reside or frequent nearshore waters, including the Ningaloo Coast, Muiron Islands, Montebello/Barrow/ Lowendal Islands Group, Pilbara Southern Island Group (see **Table 6-11**) which may be potentially impacted by entrained hydrocarbons exceeding threshold concentrations in the event of a loss of well containment. The Exmouth Gulf is a known humpback whale aggregation area on the annual southern migration (September to December); therefore, humpbacks moving into the Gulf may be exposed to entrained hydrocarbons above thresholds levels. However, entrained hydrocarbons concentrations above the threshold are not expected within Exmouth Gulf itself. No hydrocarbon contact at or above threshold concentrations is expected for Camden Sound, an important calving area for humpback whales. The potential impacts of exposure are as discussed previously in Offshore – Cetaceans. However, nearshore populations of cetaceans and dugongs are known to exhibit site fidelity and are often resident populations. Therefore, avoidance behaviour may have greater impacts to population functioning. Nearshore dolphin species (e.g. spotted bottlenose dolphins) may exhibit higher site fidelity than oceanic species, although Geraci (1988) observed relatively little impacts beyond behavioural disturbance. Additional potential environment impacts may also include the potential for dugongs to ingest hydrocarbons when feeding on oiled seagrass stands, or indirect impacts to dugongs due to loss of this food source due to dieback in worst-affected areas. Therefore, a worst-case hydrocarbon spill scenario has the potential to result in major long-term impacts to inshore cetacean species and dugongs, with consequence severity dependent on the

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Summary of Potential Impacts to Environmental Values(s)	
	actual timing, duration and extent of a spill in relation to species' migratory movements and distributions.
	Marine Turtles Several marine turtle species use nearshore waters and shorelines for foraging and breeding (including internesting), with significant nesting beaches along the mainland coast and islands in potentially impacted locations such as the Dampier Archipelago, Montebello/Barrow/Lowendal Islands Group, Pilbara Islands and Ningaloo Reef. A number of BIAs have been identified for marine turtles, including nesting, internesting and foraging areas as discussed previously in Offshore – Marine Turtles. There are distinct breeding seasons, as detailed in **Section 4.5.2.2**. The nearshore waters of these turtle habitat areas may be exposed to entrained hydrocarbons exceeding the threshold concentration. However, there is no accumulated hydrocarbons above the threshold concentration of 100 g/m^2 predicted at any shoreline location. It is noted that permanent plugging activities via the MODU will only be undertaken outside cyclone season (November to April) and will therefore avoid peak turtle nesting season where higher numbers of internesting turtles may be present (refer to **Table 4-14**). However, oil from an ongoing loss of containment could be present during nesting season depending on the timing of a spill. The potential impacts of exposure are as discussed previously in Offshore – Marine Turtles. In the nearshore environment, turtles can ingest hydrocarbons when feeding (e.g. on oiled seagrass stands/macroalgae) or can be indirectly affected by loss of food source (e.g. seagrass due to dieback from hydrocarbon exposure) (Gagnon and Rawson 2010). In addition, hydrocarbon exposure can impact turtles during the breeding season in nearshore waters. A worst-case hydrocarbon spill scenario has the potential to result in major long-term impacts to foraging marine turtles, with consequence severity dependent on the actual timing, duration and extent of a spill in relation to species' migratory movements and distributions.
	Sea snakes Impacts to sea snakes for the mainland and island nearshore waters from direct contact with hydrocarbons may occur and may include potential damage to the dermis and irritation to mucous membranes of the eyes, nose and throat (ITOPF 2011a). Therefore, a worst-case hydrocarbon spill scenario has the potential to result in major long-term impacts to sea snakes, with consequence severity dependent on the duration and extent of a spill in relation to the distribution of sea snakes.
	Sharks, Sawfish and Rays Whale sharks and manta rays are known to frequent the Ningaloo Reef system and the Muiron Islands (forming feeding aggregations in late summer/autumn). Whale sharks and manta rays generally transit along the nearshore coastline and are vulnerable to surface, entrained and dissolved aromatic hydrocarbon spill impacts, with both taxa having similar modes of feeding. Whale sharks are versatile feeders, filtering large amounts of water over their gills, catching planktonic and nektonic organisms (Jarman and Wilson 2004). Whale sharks at Ningaloo Reef have been observed using two different feeding strategies, including passive subsurface ram-feeding and active surface feeding (Taylor 2007). Passive feeding involves swimming slowly at the surface with the mouth wide open. During active feeding, sharks swim high in the water with the upper part of the body above the surface with the mouth partially open (Taylor 2007). Individuals that are present in worst-affected spill areas would have the potential to ingest toxic amounts of entrained or dissolved aromatic hydrocarbons into their body. Large amounts of ingested hydrocarbons may affect endocrine and immune systems in the longer term. The presence of hydrocarbons may displace whale sharks from the area where they normally feed and rest, and potentially disrupt migration and aggregations to these areas in subsequent seasons. Whale sharks may also be affected indirectly by surface, entrained or dissolved aromatic hydrocarbons through the contamination of their prey. The preferred food of whale sharks are fish eggs and phytoplankton, which are abundant in the coastal waters of Ningaloo Reef in late summer/autumn, driving the annual arrival and aggregation of whale sharks in this area. If the spill event occurred during the spawning season, this important food supply (in worst spill-affected areas of the reef) may be diminished or contaminated. The contamination of their food supply and the subsequent ingestion of this prey by the whale shark may also result in long-term impacts as a result of bioaccumulation. There is the potential for other resident shark and ray (e.g. sawfish species identified in **Section 4.5.2.1**) populations to be impacted directly from hydrocarbon contact or indirectly through contaminated prey or loss of habitat. **Table 6-11** indicates the receptor locations predicted to be

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Summary of Potential Impacts to Environmental Values(s)	
	contacted by entrained hydrocarbons above the threshold concentration where impacts to the benthic communities of nearshore and subtidal communities could occur, potentially resulting in habitat loss. Therefore, the consequences to resident shark and ray populations (if present) from loss of habitat, may result in a disruption to a significant portion of the population; however, it is not expected to impact the overall viability of the population. Therefore, a worst-case hydrocarbon spill scenario has the potential to result in major long-term impacts to inshore associated shark, sawfish and ray species, with consequence severity dependent on the actual timing, duration and extent of a spill in relation to species' migratory movements and distributions.
	Seabirds and/or Migratory Shorebirds In the event of a major spill, there is the potential for seabirds, and resident, non-breeding overwintering shorebirds that use the nearshore waters for foraging and resting, to be exposed to entrained, dissolved, and accumulated hydrocarbons. This could result in lethal or sublethal effects. Although breeding oceanic seabird species can travel long distances to forage in offshore waters, most breeding seabirds tend to forage in waters near their breeding colony. This results in relatively higher seabird densities in these areas during the breeding season, making these areas particularly sensitive in the event of a spill. Pathways of biological exposure that can result in impact may occur through ingesting contaminated fish (nearshore waters) or invertebrates (intertidal foraging grounds such as beaches, mudflats and reefs). Ingestion can also lead to internal injury to sensitive membranes and organs (IPIECA 2004). Whether the toxicity of ingested hydrocarbons is lethal or sublethal will depend on the weathering stage and its inherent toxicity. Exposure to hydrocarbons may have longer-term effects, with impacts to population numbers due to decline in reproductive performance and malformed eggs and chicks affecting survivorship, and loss of adult birds. Important areas for foraging seabirds and migratory shorebirds are identified in **Section 4.5.2.4**. Therefore, a worst-case hydrocarbon spill scenario has the potential to result in major long-term impacts to nearshore associated seabirds and migratory shorebirds, with consequence severity dependent on the actual timing, duration and extent of a spill in relation to species' migratory movements, breeding seasons and distributions.

Summary of potential impacts to other species	
Setting	***Receptor Group***
All Settings	***Pelagic Fish Populations*** Fish mortalities are rarely observed to occur as a result of hydrocarbon spills (ITOPF 2011b). 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, so 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. 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 hydrocarbon spills (Hjermann et al. 2007). This suggests that juvenile and adult fish are capable of avoiding water contaminated with high concentrations of hydrocarbons. However, sublethal impacts to adult and juvenile fish may be possible, given long-term exposure (days to weeks) to polycyclic aromatic hydrocarbon (PAH) concentrations (Hjermann et al. 2007), which are typically the most toxic components of hydrocarbons. Light molecular weight aromatic hydrocarbons (i.e. one- and two-ring molecules) are generally soluble in water, which increases bioavailability to gill-breathing organisms such as fish. 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 help eliminate 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 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

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Summary of potential impacts to other species	
	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 exposure in early life stages to hydrocarbons include disruption to complex behaviours 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. Demersal species are associated with the Ancient Coastline KEF, which overlaps the Operational Area. Additional KEFs that may host relatively diverse or abundant fish assemblages compared to relatively featureless continental shelf habitats occur within the wider EMBA: • Continental Slope Demersal Fish Communities KEF (5 km north-west), which has a highly diverse fish assemblage with a high degree of endemism (DAWE, 2021) • Exmouth Plateau KEF (93 km north-west), which is an important area of biodiversity (DAWE, 2021) • Canyons linking the Cuvier Abyssal Plain and the Cape Range Peninsula KEF (155 km south-west), which has been shown to host demersal fish (BMT Oceanica 2016) • Commonwealth Waters adjacent to Ningaloo Reef KEF (200 km south-west), which has high biological productivity and hosts a yearly aggregation of whale sharks (DAWE, 2021). Mortality and sublethal effects may impact populations located close to a well blowout and within the EMBA for entrained/dissolved aromatic hydrocarbons. Additionally, if prey (infauna and epifauna) surrounding the well location and within the EMBA is contaminated, this can result in the absorption of toxic components of the hydrocarbons (PAHs), potentially impacting fish populations that feed on these. Therefore, a worst-case hydrocarbon spill scenario has the potential to result in major long-term impacts to pelagic fish species, with consequence severity dependent on the actual timing, duration and extent of a spill in relation to species' migratory movements and distributions.

Summary of Potential Impacts to Marine Primary Producers	
Setting	***Receptor Group***
Submerged Shoals	The waters overlying the Rankin Bank have the potential to be exposed to entrained hydrocarbons above threshold concentrations (≥100 ppb). Potential biological impacts could include sublethal stress and, in some instances, total or partial mortality of sensitive benthic organisms such as corals and the early life stages of resident fish and invertebrate species. Therefore, a worst-case hydrocarbon spill scenario has the potential to result in major long-term impacts to primary producer groups at Rankin Bank.
Mainland and Islands (nearshore waters)	***Coral Reef*** The quantitative spill risk assessment indicates there would be potential for coral reef habitat to be exposed to entrained hydrocarbons at locations including the Montebello Islands, Barrow Island, Lowendal Islands, discrete locations within the Pilbara Islands Southern Island Group, Muiron Islands and Ningaloo Coast (**Table 6-11**). Exposure to entrained hydrocarbons (≥100 ppb) has the potential to result in lethal or sublethal toxic effects to corals and other sensitive sessile benthos within the upper water column (top 20 m), including upper reef slopes (subtidal corals), reef flat (intertidal corals) and lagoonal (back reef) coral communities. Mortality in a number of coral species is possible, and this could result in the reduction of coral cover and change in the composition of coral communities. Sublethal effects to corals may include polyp retraction, changes in feeding, bleaching (loss of zooxanthellae), increased mucous production resulting in reduced growth rates, and impaired reproduction (Negri and Heyward 2000). This could result in impacts to the shallow water fringing coral communities/reefs of the offshore islands (e.g. Barrow/Montebello/Lowendal Islands, Pilbara Southern Island Groups) and the mainland coast (i.e. Ningaloo Coast). With reference to Ningaloo Reef, wave-induced water circulation flushes the lagoon and may promote removal of entrained hydrocarbons from this particular reef habitat. Under typical conditions, breaking waves on the reef crest induce a rise in water level in the lagoon,

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Summary of Potential Impacts to Marine Primary Producers	
	creating a pressure gradient that drives water in a strong outward flow through channels. These channels are across as much as 15% of the length of Ningaloo Reef (Taylor and Pearce 1999). If a spill occurs at the time of coral spawning at potentially affected coral locations, or in the general peak period of biological productivity, there is the potential for a significant reduction in successful fertilisation and coral larval survival, due to the sensitivity of coral early life stages to hydrocarbons (Negri and Heyward 2000). Such impacts are likely to result in the failure of recruitment and settlement of new population cohorts. In addition, some non-coral species may be affected via direct contact with entrained hydrocarbons, resulting in sublethal impacts and in some cases mortality—particularly early life-stages of coral reef animals (reef-attached fishes and reef invertebrates), which can be relatively sensitive to hydrocarbon exposure. Coral reef fish are site-attached, have small home ranges, and as reef residents they are at higher risk from hydrocarbon exposure than non-resident, more wide-ranging fish species. The exact impact on resident coral communities (which may include fringing reefs of the offshore islands and/or the Ningaloo Reef system) will depend on actual hydrocarbon concentration, duration of exposure and water depth of the affected communities. Over the worst-affected sections of reef habitat, coral community live cover, structure and composition may reduce, manifested by loss of corals and associated sessile biota. Recovery of these impacted reef areas typically relies on coral larvae from neighbouring coral communities that have either not been affected or only partially impacted. For example, there is evidence that Ningaloo Reef corals and fish are partly self-seeding, with the supply of larvae from locations within Ningaloo Reef of critical importance to the healthy maintenance of the coral communities (Underwood 2009). Recovery at other coral reef areas may not be aided by a large supply of larvae from other reefs, with levels of recruits after a disturbance event only returning to previous levels after the numbers of reproductive corals had also recovered (Gilmour et al. 2013). Therefore, a worst-case hydrocarbon spill scenario has the potential to result in large scale impacts to coral populations within the EMBA, with long-term effects (recovery >10 years) likely. The consequence severity is predicted to be greatest at reefs closest to the potential release location (e.g. Montebello Islands).
	Seagrass Beds/Macroalgae Spill modelling has predicted that entrained hydrocarbons above threshold concentrations have the potential to contact a number of nearshore locations that support biologically diverse, shallow subtidal and intertidal communities. The variety of habitat and community types, from the upper subtidal to the intertidal zones support a high diversity of marine life and are used as important foraging and nursery grounds by a range of invertebrate and vertebrate species. Depending on the trajectory of the entrained plume, macroalgal/seagrass communities including the Barrow/Montebello/Lowendal Islands, the Pilbara Islands (documented as low and patchy cover), and the Ningaloo Coast (patchy and low cover associated with the shallow limestone lagoonal platforms), all have the potential to be exposed (see **Table 6-11** for a full list of receptors within the EMBA). Exposure to entrained hydrocarbons may result in mortality, depending on actual entrained exposure concentrations received and duration of exposure. Physical contact with entrained hydrocarbon droplets could cause sublethal stress, causing reduced growth rates and reduced tolerance to other stress factors (Zieman et al. 1984). Toxicity effects can also occur due to absorption of soluble fractions of hydrocarbons into tissues (Runcie et al. 2010). However, the potential for toxicity effects of entrained hydrocarbons may be reduced by weathering processes that should lower the content of soluble aromatic components before contact occurs. Mangrove habitat at Ningaloo Coast, Pilbara islands, and Montebello Islands may be contacted by entrained hydrocarbons within the EMBA (see **Table 6-11**). Entrained hydrocarbons may adhere to the sediment particles and in low-energy environments such as in mangroves, deposited sediment-bound hydrocarbons are unlikely to be removed naturally by wave action and may be deposited in layers by successive tides (NOAA 2014). Hydrocarbons may persist in the sediment, potentially causing chronic sublethal toxicity impacts beyond immediate physical and acute effects, which may delay recovery in an affected area. Recovery of mangroves from any impacts could be long-term (>10 years). Therefore, a worst-case hydrocarbon spill scenario has the potential to result in major long-term impacts to seagrass beds and macroalgae communities within the EMBA, with consequence severity predicted to be greatest at receptors closest to the potential release location (e.g. Montebello Islands).

Summary of Potential Impacts to Other Habitats and Communities	
Setting	***Receptor Group***
Offshore	***Benthic Fauna Communities***

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Summary of Potential Impacts to Other Habitats and Communities	
	In the event of a major release at the seabed, the stochastic spill model predicted hydrocarbons droplets would be entrained, rapidly transporting them to the sea surface. As a result, the low sensitivity benthic communities associated with the unconsolidated, soft sediment habitat and any epifauna (filter feeders) associated with KEFs within the wider EMBA are not expected to have widespread exposure to released hydrocarbons (Continental Slope Demersal Fish Communities KEF, Canyons KEF, Exmouth Plateau KEF and Commonwealth Waters adjacent to Ningaloo Reef KEF (**Section 4.5.3**). Therefore, a worst-case hydrocarbon spill scenario has the potential to result in minor, short-term impacts to seabed and associated epifauna and infauna within the EMBA, with impacts predicted to be greatest for habitats closest to the potential release location.
	Open Water – Productivity/Upwelling Primary production by plankton (triggered by sporadic upwelling events in the offshore waters) is an important component of the primary marine food web. Planktonic communities are generally mixed, including phytoplankton (cyanobacteria and other microalgae), secondary consuming zooplankton (e.g. copepods), and the eggs and larvae of fish and invertebrates (meroplankton). Exposure to hydrocarbons in the water column can result in changes in 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 2011a). Therefore, a worst-case hydrocarbon spill scenario has the potential to result in minor, short-term impacts to plankton populations within the EMBA, with impacts predicted to be greatest for habitats closest to the potential release location.
	Filter Feeders Entrained hydrocarbons above the 100 ppb ecological thresholds will be limited to the top 20 m of the water column beyond the immediate source. Entrained hydrocarbons are therefore not expected to impact filter feeder habitats in deep offshore waters including filter feed communities associated with the Continental Slope Demersal Fish Communities KEF, Canyons KEF, Exmouth Plateau KEF and Commonwealth Waters adjacent to Ningaloo Reef KEF. Refer to ‘mainland and islands (nearshore waters) for a description of potential impacts to filter feeders in shallower waters.
Mainland and Islands (Nearshore Waters)	***Open Water – Productivity/Upwelling*** Nearshore waters and adjacent offshore waters surrounding the offshore islands (e.g. Montebello/ Barrow/Lowendal Islands Group) and to the west of the Ningaloo Reef system are known locations of seasonal upwelling events and productivity. The seasonal productivity events are critical to krill production, which supports megafauna aggregations such as whale sharks and manta rays in the region. This has the potential to result in lethal and sublethal impacts to a certain portion of plankton in affected areas, depending on concentration and duration of exposure and the inherent toxicity of the hydrocarbon. However, recovery would occur (see Offshore description above). Therefore, a worst-case hydrocarbon spill scenario has the potential to result in minor, short-term impacts to plankton populations within the EMBA.
	Spawning/Nursery Areas Fish (and other commercially targeted taxa) in their early life stages (eggs, larvae and juveniles) are at their most vulnerable to lethal and sublethal impacts from exposure to hydrocarbons, particularly if a spill coincides with spawning seasons or reaches nursery areas close to the shore (e.g. seagrass and mangroves) (ITOPF 2011a). Fish spawning (including for commercially targeted species such as snapper and mackerel) occurs in nearshore waters at certain times of the year, and nearshore waters are also inhabited by higher numbers of juvenile fishes than offshore waters. Modelling indicated that, in the event of a major spill, there is potential for entrained hydrocarbons to occur in the surface water layers above threshold concentrations in nearshore waters, including Montebello/Barrow/Lowendal Islands Group, Pilbara Southern Islands Groups, Ningaloo Coast, and the Muiron Islands. This has the potential to result in lethal and sublethal impacts to a portion of fish larvae in areas contaminated above impact thresholds, depending on concentration and duration of exposure and the inherent toxicity of the hydrocarbon. Although there is the potential for spawning/nursery habitat to be impacted (e.g. mangroves and seagrass beds, discussed above), losses of fish larvae in worst-affected areas are unlikely to be of major consequence to fish stocks

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<table>
<tr><th colspan="2">Summary of Potential Impacts to Other Habitats and Communities</th></tr>
<tr><td></td><td>compared with significantly larger losses through natural predation, and the likelihood that most nearshore areas would be exposed is low (i.e. not all areas in the region would be affected). This is supported by a study in the Gulf of Mexico, which used juvenile abundance data from shallow-water seagrass meadows as indices of the acute, population-level responses of young fishes to the Deepwater Horizon spill. Results indicated that there was no change to the juvenile cohorts following the Deepwater Horizon spill. Additionally, there were no significant post-spill shifts in community composition and structure, nor were there changes in biodiversity measures (Fodrie and Heck 2011).
Therefore, a worst-case hydrocarbon spill scenario has the potential to result in major long-term impacts to spawning fish and/or nursery areas within the EMBA, with consequence severity dependent on the actual timing, duration and extent of a spill in relation to key spawning periods and locations.</td></tr>
<tr><td></td><td><i>Non-biogenic Reefs</i>
The reef communities fringing the Pilbara region (e.g. Pilbara islands) may be exposed to entrained hydrocarbons (at or above the threshold concentration), and consequently exhibit lethal or sublethal impacts resulting in partial or total mortality of keystone sessile benthos, particularly hard corals; thus, potential community structural changes to these shallow, nearshore benthic communities may occur. If these reefs are exposed to entrained hydrocarbons, impacts are expected to result in localised long-term effects.
Therefore, a worst-case hydrocarbon spill scenario has the potential to result in minor, short-term impacts to non-biogenic reefs within the EMBA.</td></tr>
<tr><td></td><td><i>Filter Feeders</i>
Hydrocarbon exposure to shallow nearshore filter feeding communities (<20 m) (e.g. Montebello Islands) may occur. Exposure to entrained aromatic hydrocarbons has the potential to result in lethal or sublethal toxic effects. Sublethal impacts, including mucus production and polyp retraction, have been recorded for gorgonians exposed to hydrocarbon (White et al. 2012). Any impacts may result in localised long-term effects to community structure and habitat.
Nearshore filter feeders that are present in shallower water <20 m may potentially be impacted by entrained hydrocarbon through lethal/sublethal effects, although given the distance from source hydrocarbons are expected to be less toxic due to the weathering process. Such impacts may result in localised, long term effects to community structure and habitat.
Therefore, a worst-case hydrocarbon spill scenario has the potential to result in minor, short-term impacts to filter feeders within the EMBA.</td></tr>
<tr><td><i>Key Ecological Features</i></td><td><i>Key Ecological Features</i>
KEFs potentially impacted by the hydrocarbon spill from a loss of well containment event are detailed in Section 4.5.3. Although these KEFs are primarily defined by seabed geomorphological features, they can indicate a potential for increased biological productivity and, therefore, ecological significance.
The consequences of a hydrocarbon spill from a loss of well containment event are predicted to result in minor impacts to values of the KEFs affected (for the values of each KEF, see Section 4.5.3). Impacts to benthic habitats are not predicted fiven the maximum depth of entrained hydrocarbons above 100 ppb is predicted to be 20 m beyond the immediate source. Potential impacts to associated pelagic communities may occur as described above and below. The KEFs within the EMBA have relatively broad-scale distributions and are unlikely to be significantly impacted.
Therefore, a worst-case hydrocarbon spill scenario has the potential to result in minor, short-term impacts to the ecological values of KEFs within the EMBA, with impacts predicted to be greatest for habitats closest to the potential release location.</td></tr>
</table>

<table>
<tr><th colspan="2">Summary of Potential Impacts to Water Quality</th></tr>
<tr><td><i>Setting</i></td><td><i>Aspect</i></td></tr>
<tr><td><i>All Settings</i></td><td><i>Open Water – Water Quality</i>
Water quality would be affected due to hydrocarbon contamination above impact thresholds. These are defined by the EMBA descriptions for each of the entrained and dissolved hydrocarbon fates and their predicted extent. Therefore, a worst-case hydrocarbon spill scenario has the potential to result in minor, short-term impacts to water quality within the EMBA, with impacts predicted to be greatest for areas closest to the potential release location.</td></tr>
</table>

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Summary of potential impacts to marine sediment quality	
Setting	***Receptor Group***
Offshore	***Marine Sediment Quality*** Studies of hydrocarbon concentrations in deep-sea sediments in the vicinity of a catastrophic well blowout indicated hydrocarbon from the blowouts can be incorporated into sediments (Romero et al. 2015). Proposed mechanisms for hydrocarbon contamination of sediments include sedimentation of hydrocarbons and direct contact between submerged plumes and the seabed (Romero et al. 2015). In the event of a major hydrocarbon release at the seabed, modelling indicates that a pressurised release of hydrocarbon would form droplets that would be transported into the water column to the surface (i.e. transported away from the seabed). As a result, the extent of potential impacts to the seabed area at and surrounding the release site would be largely confined to a localised footprint. Marine sediment quality would be reduced as a consequence of hydrocarbon contamination for a small area within the immediate release site for a long to medium term, as hydrocarbons in sediments typically undergo slower weathering and degradation (Diercks et al. 2010, Liu et al. 2012). There is the potential for floating and entrained hydrocarbons to sink following extensive weathering and adsorption of sediment particles, which may result in the deposition of hydrocarbons to the seabed in areas distant from the release location. Such hydrocarbons are expected to be less toxic due to the weathering process. Therefore, a worst-case hydrocarbon spill scenario has the potential to result in slight, short-term impacts to offshore sediment quality within the EMBA, with impacts predicted to be greatest for areas closest to the potential release location.
Mainland and Islands (Nearshore waters)	***Marine Sediment Quality*** Entrained hydrocarbons (at or above the defined threshold) are predicted to potentially contact shallow, nearshore waters of identified islands and mainland coastlines. Such hydrocarbon contact may lead to reduced marine sediment quality through adherence to sediment. Therefore, a worst-case hydrocarbon spill scenario has the potential to result in minor, short-term impacts to sediment quality within the EMBA, with impacts predicted to be greatest for areas closest to the potential release location.

Summary of Potential Impacts to Air Quality

A hydrocarbon release during a loss of well containment has the potential to result in short-term reduction in air quality. There is potential for human health effects on workers in the immediate vicinity of atmospheric emissions. The ambient concentrations of VOCs released from diffuse sources is difficult to accurately quantify, although their behaviour and fate is predictable in open offshore environments, as VOC emissions disperse rapidly by meteorological factors such as wind and temperature. VOC emissions from a hydrocarbon release in such environments are rapidly degraded in the atmosphere by reaction with photochemically produced hydroxyl radicals.

Given the remote likelihood of occurrence of a loss of well containment, the temporary nature of any VOC emissions (from either gas surfacing or weathering of liquid hydrocarbons from a loss of well containment), the predicted behaviour and fate of VOCs in open offshore environments, and the significant distance from the Operational Area to the nearest sensitive airshed (town of Dampier ~170 km away), a worst-case hydrocarbon spill scenario has the potential to result in minor, short-term impacts to air quality within the EMBA, with impacts predicted to be greatest for areas closest to the potential release location.

Summary of Potential Impacts to Protected Areas

The quantitative spill risk assessment results indicate that the open-water environment protected within a number of Commonwealth AMPs (refer to **Table 6-11**) may be affected by released hydrocarbons in the event of a loss of well containment. In the Remote likelihood of a major spill occurring, entrained hydrocarbons may contact the identified key receptor locations of islands and mainland coastlines and shoreline accumulation may occur above the socio-cultural threshold (but below the ecological threshold) at limited locations, resulting in the actual or perceived contamination of protected areas as identified for the EMBA.

Impact on the protected areas is discussed in the sections above for ecological values and sensitivities, and below for socioeconomic values. Additionally, such hydrocarbon contact may alter stakeholder understanding and/or perception of the protected marine environment, given these represent areas are largely unaffected by anthropogenic influences and contain biologically diverse environments.

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<table>
<tr><th colspan="2">Summary of Potential Impacts to Socioeconomic Values</th></tr>
<tr><th>Setting</th><th>Receptor Group</th></tr>
<tr><td>Offshore</td><td>Fisheries – Commercial
A hydrocarbon release during a loss of well containment event has the potential to result in direct impacts to target species of Commonwealth and State fisheries within the defined EMBA (refer Section 4.6.2). Lethal and sublethal effects may impact localised populations of targeted species within the EMBA for entrained/dissolved hydrocarbons. However, entrained hydrocarbons are likely to be confined in the upper water column; therefore, demersal species are less likely to be exposed to hydrocarbons than pelagic species. A major loss of hydrocarbons from the Petroleum Activities Program may also lead to an exclusion of fishing from the spill-affected area for an extended period.
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 its efficacy depends on 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 seafood contamination 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 would result in the establishment of an 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 minor economic impacts to affected commercial fishing operators.
Therefore, a worst-case hydrocarbon spill scenario has the potential to result in major, long-term impacts to commercial fisheries within the EMBA, particularly for pelagic fisheries and fisheries with most of their effort focused within the EMBA (e.g. Pilbara Demersal Scalefish Managed Fishery and Mackerel Managed Fishery). Potential impacts to inshore fisheries are discussed in the Mainland and Islands (nearshore) impacts discussion below, and the impact assessment relating to spawning is discussed above.</td></tr>
<tr><td></td><td>Tourism including Recreational Activities
Recreational fishers predominantly target large tropical species, such as emperor, snapper, grouper, mackerel, trevally and other game fish. Recreational angling activities include shore-based fishing, private boat and charter boat fishing, with peak activity between April and October (Smallwood et al. 2011) for the Exmouth region. Limited recreational fishing takes place in the offshore waters of the Operational Area. Impacts on species that are recreationally fished are described above under Summary of Potential Impacts to Other Species.
A major loss of hydrocarbons from the Petroleum Activities Program may lead to exclusion of marine nature-based tourist activities, resulting in a loss of revenue for operators. Tourism is a major industry for the region and visitor numbers would likely reduce if a hydrocarbon spill were to occur, based on the perception of hydrocarbon spills and associated impacts.
Therefore, a worst-case hydrocarbon spill scenario has the potential to result in moderate, medium-term impacts to tourism and recreation within the EMBA.</td></tr>
<tr><td></td><td>Offshore Oil and Gas Infrastructure
A hydrocarbon release during a loss of well containment event has the potential to result in disruptions to production at existing petroleum facilities (platforms and FPSOs), as well as activities such as drilling and seismic exploration. For example, facility water intakes for cooling and fire hydrants could be shut off if contacted by floating hydrocarbons, which could in turn lead to the temporary cessation of production activities. Spill exclusion zones established to manage the spill could also prohibit access for activity support vessels as well as offtake tankers approaching facilities off the North West Cape. 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 facilities are:
• Pluto platform (operated by Woodside): 14 km from the Operational Area
• Wheatstone platform (operated by Chevron): 22 km from the Operational Area
• John Brookes (operated by Santos WA Southwest P/L): 39 km from the Operational Area.
Operation of these facilities is likely to be affected in the event of a well blowout spill. Therefore, a worst-case hydrocarbon spill scenario has the potential to result in slight, short-term impacts to oil and gas industry within the EMBA.</td></tr>
</table>

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<table>
<tr><th colspan="2">Summary of Potential Impacts to Socioeconomic Values</th></tr>
<tr><td><i>Submerged Shoals</i></td><td><i>Tourism and Recreation</i>
A hydrocarbon release during a loss of well containment event has the potential to result in a temporary prohibition on charter boat recreational fishing/diving and any other marine nature-based tourism trips to Rankin Bank. Therefore, a worst-case hydrocarbon spill scenario has the potential to result in minor, short-term impacts to tourism and recreational activities within the EMBA.</td></tr>
<tr><td><i>Mainland and Islands (Nearshore Waters)</i></td><td><i>Fisheries – Commercial</i>
<u>Nearshore Fisheries</u>
In the event of a loss of well containment, there is the possibility that target species in some areas used by a number of state fisheries could be affected (refer to Section 4.6.2 for fisheries within the wider EMBA). Targeted fish, prawn, mollusc and lobster species could experience sublethal stress, or in some instances mortality, depending on the concentration and duration of hydrocarbon exposure and its inherent toxicity.
<u>Prawn Managed Fisheries</u>
In the event of a major spill, the modelling indicated the entrained and dissolved EMBA may extend to nearshore waters, including the actively fished areas of the designated Exmouth Gulf Prawn Managed Fishery and Nickol Bay Prawn Managed Fishery.
Prawn habitat usage differs between species in the post-larval, juvenile and adult stages (Dall et al. 1990) and direct impacts to benthic habitat due to a major spill have the potential to impact prawn stocks. For example, juvenile banana prawns are found almost exclusively in mangrove-lined creeks (Rönnbäck et al. 2002), whereas juvenile tiger prawns are most abundant in areas of seagrass (Masel and Smallwood 2000). Adult prawns also inhabit coastline areas but tend to move to deeper waters to spawn. In the event of a major spill, a range of subtidal habitats that support juvenile prawns may be exposed to hydrocarbons above impact thresholds, including:
• Montebello Islands
• Barrow Island
• Lowendal Islands
• Pilbara Southern Island Group
• Ningaloo Coast.
Localised loss of juvenile prawns in the worst spill-affected areas is possible. Whether lethal or sublethal effects occur will depend on duration of exposure, hydrocarbon concentration and weathering stage of the hydrocarbon, and its inherent toxicity. Furthermore, seafood consumption safety concerns and a temporary prohibition on fishing activities may lead to subsequent potential for economic impacts to affected commercial fishing operators.
Therefore, a worst-case hydrocarbon spill scenario has the potential to result in major, long-term impacts to commercial fisheries within the EMBA.</td></tr>
<tr><td></td><td><i>Tourism and Recreation</i>
In the event of a major spill, the nearshore waters of offshore islands and reefs as well as the Ningaloo coast could be reached by entrained and dissolved hydrocarbons depending on prevailing wind and current conditions. There is also a low probability of shoreline accumulation above the socio-cultural threshold (but not the ecological threshold) at limited locations. As these locations offer a number of amenities such as fishing, swimming and using beaches and surrounds, they have a recreational value for local residents and visitors. If a well blowout event resulted in hydrocarbon contact, there could be restricted access to beaches for a period of days to weeks, until natural weathering, tides, currents or oil spill response (e.g. shoreline clean-up if safe to do so) removes the hydrocarbons. In the event of a well blowout, tourists and recreational users may also avoid areas due to perceived impacts, including after the oil spill has dispersed.
There is the potential for stakeholder perception that this environment will be contaminated over a large area and for the longer term, resulting in a prolonged period of tourism decline. Oxford Economics (2010) assessed the duration of hydrocarbon spill-related tourism impacts and found that, on average, it took 12 to 28 months to return to baseline visitor spending. There is likely to be significant impacts to the tourism industry, wider service industry (hotels, restaurants and their supply chain) and local communities in terms of economic loss as a result of spill impacts to tourism. Recovery and return of tourism to pre-spill levels will depend on the size of the spill, effectiveness of the spill clean-up, and change in any public perceptions regarding the spill (Oxford Economics 2010).
Therefore, a worst-case hydrocarbon spill scenario has the potential to result in moderate, medium-term impacts to tourism and recreational activities within the EMBA.</td></tr>
</table>

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<table>
<tr><th colspan="2">Summary of Potential Impacts to Socioeconomic Values</th></tr>
<tr><td></td><td><i>Cultural Heritage</i>
A number of Underwater Cultural Heritage sites (including historic shipwrecks) have been identified in the vicinity of Operational Area. The spill modelling results do not predict surface slicks will contact any identified wrecks. However, shipwrecks occurring in the subtidal zone will be exposed to entrained/dissolved hydrocarbons, and marine life that shelter and take refuge in and around these wrecks may be affected by in-water toxicity of dispersed hydrocarbons. The consequences of such hydrocarbon exposure may include large fish species moving away, and/or resident fish species and sessile benthos such as hard corals exhibiting sublethal and lethal impacts (which may range from physiological issues to mortality).
Entrained hydrocarbons above the threshold concentration are predicted at the Montebello/ Barrow/ Lowendal islands. There is also a low probability of shoreline accumulation above the socio-cultural threshold (but not the ecological threshold). However, artefacts, scatter and rock shelters are on land above the high water mark on Barrow and Montebello islands; therefore, no contact is predicted for these areas.
Within the wider EMBA are several designated heritage places (Section 4.6.1). These places are also covered by other designations such as World Heritage Area. Potential impacts are discussed in the sections above.</td></tr>
<tr><th colspan="2">Summary of Potential Impacts to Environmental Value(s)</th></tr>
<tr><td colspan="2">In the highly unlikely event of a major hydrocarbon spill due to a loss of well integrity, the EMBA includes the areas listed in Table 6-11, including the sensitive offshore marine environments and associated receptors of the Montebello AMP, Gascoyne AMP, Ningaloo AMP and Rankin Bank. In summary, long-term impacts may occur at sensitive nearshore and shoreline habitats, particularly areas of the Barrow and Montebello Islands, as a result of a major spill of hydrocarbon from permanent plugging activities within the Operational Area.
The overall environmental consequence is defined as ‘B – Major, long-term impact (ten to 50 years) on highly valued ecosystem, species, habitat, physical or biological attributes’.</td></tr>
</table>

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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				
OPGGS (Resource Management and Administration) Regulations 2011: accepted WOMP which describes the well integrity outcomes, control measures and performance criteria used to demonstrate how the risk of loss of well integrity is managed to ALARP including the well design and barriers to be used to prevent a loss of well integrity, which aligns with industry guidance and good practice.	F: Yes. CS: Minimal cost. Standard practice.	Compliance with an accepted WOMP will ensure a number of barriers are in place and verified, reducing the likelihood of a loss of well integrity event occurring. Although the consequence of a blowout would not be reduced, the reduction in likelihood reduces the overall risk.	Benefits outweigh cost/sacrifice.	Yes **C 9.2**
In the event of a spill, emergency response activities implemented in accordance with the OPEP (per **Table 7-4**).	F: Yes. CS: Costs associated with implementing response strategies, vary dependant on nature and scale of spill event. Standard practice.	This control would not reduce the likelihood, but response activities may reduce the consquence.	Benefits outweigh cost/sacrifice.	Yes **C 11.1**
Arrangements supporting the activities in the OPEP (per **Table 7-4**) will be tested to ensure the OPEP can be implemented as planned.	F: Yes. CS: Moderate costs associated with exercises. Standard practice.	Testing the OPEP activities would not reduce the likelihood, but response activities may reduce the consquence.	Benefits outweigh cost/sacrifice.	Yes **C 11.2**
Good Practice				

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[21] Qualitative measure.

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<table>
<tr><th colspan="5">Demonstration of ALARP</th></tr>
<tr><th>Control Considered</th><th>Control Feasibility (F) and Cost/Sacrifice (CS) [21]</th><th>Benefit in Impact/Risk Reduction</th><th>Proportionality</th><th>Control Adopted</th></tr>
<tr><td>Subsea BOP installed, and function tested during permanent plugging operations. The BOP shall meet the Woodside Well Control Procedure, Woodside Engineering Standard – Rig Equipment and shall be subject to API Standard 53 BOP Risk Assessment.</td><td>F: Yes.
CS: Standard practice. Required by Woodside standards.</td><td>Testing of the BOP will reduce the likelihood of a blowout resulting in release of hydrocarbons to the marine environment. In the event of a blowout, this control would not reduce the consequence, although the reduction in likelihood reduces the overall risk ranking.</td><td>Benefits outweigh cost/sacrifice.</td><td>Yes
C 11.3</td></tr>
<tr><td>Project specific Mooring Design Analysis.</td><td>F: Yes.
CS: Standard practice. Required by Woodside standards.</td><td>Ensure adequate MODU station holding capacity to prevent loss of station keeping. This will reduce the likelihood of a blowout resulting in release of hydrocarbons to the marine environment.</td><td>Benefits outweigh cost/sacrifice.</td><td>Yes
C 3.1</td></tr>
<tr><td>Mitigation: Oil Spill Response</td><td colspan="4">Refer to Appendix D</td></tr>
<tr><td colspan="5">Professional Judgement – Eliminate</td></tr>
<tr><td>Do not plug and abandon the wells.</td><td>F: No.
CS: Inability to permanently abandon the well.</td><td>All risk would be eliminated.</td><td>Disproportionate. The wells require intervention to achieve the status of permanently abandoned.</td><td>No</td></tr>
<tr><td colspan="5">Professional Judgement – Substitute</td></tr>
<tr><td colspan="5">No additional controls identified.</td></tr>
<tr><td colspan="5">Professional Judgement – Engineered Solution</td></tr>
<tr><td colspan="5">No additional controls identified.</td></tr>
<tr><td colspan="5">Risk Based Analysis</td></tr>
<tr><td colspan="5">A quantitative spill risk assessment was performed (refer Section 6.7.1).</td></tr>
<tr><td colspan="5">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 B, Section 2.6.1), Woodside considers the adopted controls appropriate to manage the risks and consequences of a highly unlikely unplanned hydrocarbon release as a result of a loss of well integrity. As no reasonable additional/alternative controls were identified that would further reduce the risks and consequences without grossly disproportionate sacrifice, the risks and consequences are considered ALARP.</td></tr>
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Demonstration of Acceptability

Acceptability Criteria and Assessment

Principles of ESD

The impact and risk evaluation has taken into account the following relevant principles of ESD:

- decision-making processes should effectively integrate both long-term and short-term economic, environmental, social and equitable considerations
- the principle of inter-generational equity—that the present generation should ensure that the health, diversity and productivity of the environment is maintained or enhanced for the benefit of future generations
- the conservation of biological diversity and ecological integrity should be a fundamental consideration in decision-making.

Internal Context

The Petroleum Activities Program is consistent with Woodside corporate policies, culture, processes, standards, structure and systems as outlined in the Demonstration of ALARP and Environmental Performance Outcomes, including:

- Woodside Health, Safety, Environment and Quality Policy (**Appendix A**)
- Woodside Risk Management Policy (Appendix A)
- Engineering Standards – Well Barriers
- Well Acceptance Criteria Procedure
- Drilling and Completions – Well Control Procedure
- Woodside Engineering Standard – Rig Equipment
- Source Control Emergency Response Planning Guideline (SCERP Guidelines)
- Oil spill preparedness and response strategies are considered applicable to the nature and scale of the risk and associated impacts of the response are reduced to ALARP (**Appendix D).**

External Context

During stakeholder consultation with relevant persons, DoT requested to be consulted on spill risks with a potential to impact State Waters (**Section 5**). Woodside has also consulted with AMSA on spill response strategies. In accordance with the MoU between Woodside and AMSA, a copy of the Oil Pollution First Strike Plan was provided to AMSA and DoT. No additional queries or concerns relating to a loss of well integrity hydrocarbon spill risk were raised during stakeholder engagement.

Other Requirements

Impact assessment has been informed by risk-based analysis, including hydrocarbon spill modelling. The proposed control measures are consistent with industry legislation, codes and standards, good practice and professional judgement including:

- API Standard 53 for subsea BOP function testing
- APPEA *Memorandum of Understanding: Mutual Assistance* for relief well drilling is in place. Woodside develops an activity SCERP, including the Relief Well Plan, which is signed off by the Drilling Engineering Manager and maintains a list of rigs that are currently operating in Australia (refer also to **Appendix D**).
- OPGGS (Resource Management and Administration) Regulations 2011 to have an accepted WOMP and application to permanently plug for abandonment of the wells
- NOPSEMA will be notified of reportable and recordable incidents, if required, in accordance with **Section 7.8.** A mutual aid MoU for relief well drilling is in place and the Drilling Engineering Manager maintains a list of rigs that are currently operating in WA.

The EMBA overlaps a number of BIAs for threatened and migratory species, as well as a number of State and Commonwealth MPAs and the Ningaloo Coast WHA. As demonstrated in **Section 6.8**, the residual risk of accidental hydrocarbon release from loss of well integrity is not inconsistent with the relevant objectives and actions of any applicable recovery plans or threat abatement plans. Regard has been given to relevant conservation advice and wildlife conservation plans during the assessment of potential impacts. The Petroleum Activities Program is not considered to be inconsistent with the overall recovery objectives and actions of these recovery plans and conservation advice (**Section 6.8**).

Acceptability Statement

The impact assessment has determined that an accidental hydrocarbon release as a result of a loss of well integrity represents a moderate current risk rating and may result in major, long-term impacts (10 - 50 years) on highly valued ecosystems, species, habitat or physical or biological attributes. BIAs within the Operational Area include flatback turtle internesting, whale shark foraging, and wedge-tailed shearwater breeding BIA. Relevant recovery plans and

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conservation advice have been considered during the impact assessment, and the Petroleum Activities Program is not considered to be inconsistent with the overall recovery objectives and actions of these recovery plans and conservation advice.

The likelihood of a loss of well integrity occurring is highly unlikely, given the adopted controls. The adopted controls are considered consistent with industry legislation, codes and standards, and professional judgement and a risk-based assessment has been conducted to better understand the potential consequences and plan oil spill response. The adopted controls also meet the requirements and expectations of Australian Marine Orders, AMSA and AHS identified during impact assessment and stakeholder consultation. As demonstrated in **Section 6.8**, the potential impacts of hydrocarbon release from loss of well integrity is not inconsistent with the relevant objectives and actions of any applicable recovery plans or threat abatement plans. Regard has been given to relevant conservation advice during the assessment of potential risks. On the basis of the environmental impact assessment outcomes and Woodside's criteria for acceptability outlined in **Section 2.7.2**, this is considered an acceptable level of risk.

Environmental Performance Outcomes, Standards and Measurement Criteria			
Outcomes	***Controls***	***Standards***	***Measurement Criteria***
EPO 11 No loss of well integrity resulting in loss of hydrocarbons to the marine environment during the Petroleum Activities Program.	**C 9.2** See **Section 6.6.7.**	**PS 9.2** See **Section 6.6.7.**	**MC 9.2.1** See **Section 6.6.7.**
			MC 9.2.2 See **Section 6.6.7.**
	C 3.1 See **Section 0.**	**PS 3.1** See **Section 0.**	**MC 3.1.1** See **Section 0.**
	C 11.1 In the event of a spill emergency response activities implemented in accordance with the OPEP (per Table 7-4).	**PS 11.1** In the event of a spill the OPEP (per Table 7-4) requirements are implemented.	**MC 11.1.1** Completed incident documentation.
	C 11.2 Arrangements supporting the activities in the OPEP (per Table 7-4) will be tested to ensure the OPEP can be implemented as planned.	**PS 11.2.1** Exercises/tests will be conducted in alignment with the frequency identified in **Table 7-7**.	**MC 11.2.1** Testing of arrangement records confirm that emergency response capability has been maintained.
		PS 11.2.2 Woodside's procedure demonstrates a minimum level of trained personnel, for core roles in the OPEP (per Table 7-4), are maintained.	**MC 11.2.2** Emergency Management dashboard confirms that minimum level of personnel trained for core OPEP roles are available.
	C11.3 Subsea BOP installed and fuction tested during permanent plugging operations.	**PS 11.3.1** Subsea BOP specification, installation and function testing compliant with internal Woodside Standards and international requirements (API Standard 53) as agreed by Woodside and MODU contractor.	**MC 11.3.1** Records demonstrate that BOP and BOP control system specifications and function testing were in accordance with minimum standards for the expected permanent plugging conditions as agreed by Woodside and MODU contractor.
For oil spill response outcomes, standards and MC refer to **Appendix D**.			

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6.7.3 Unplanned Hydrocarbon Release: Loss of Well Containment (Accidental Damage to, or Removal of, Xmas Tree during Well P&A Activities)

Context		
Permanent Plugging Activities – **Section 3.10** Disturbance to Seabed from Dropped Objects – **Section 6.7.11**	Physical Environment – **Section 4.4** Biological Environment – **Section 4.5** Socioeconomic and Cultural – **Section 4.6**	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 / Impact	Likelihood	Current Risk Rating	ALARP Tools	Acceptability	Outcome
Loss of well containment due to accidental damage to, or removal of, Xmas tree resulting from anchor drag or dropped object during the preservation period or well P&A activities, with a leak past the sub-surface safety valve (SSSV).		X	X		X	X	X	A	E	1	L	LCS GP PJ RBA	Broadly acceptable	EPO 12

Description of Source of Risk

Credible Scenario – Loss of Well Containment due to Accidental Removal of Xmas tree During the Preservation Period or Well P&A Due to Anchor Drag or Dropped Object

All subsea wells currently have the Xmas tree retained in situ following cessation of production, with no wells currently having any deep-set plugs installed below the wellhead. The Xmas tree, along with the SSSV, provides barriers between the reservoir and the environment. Wells plugged during the Petroleum Activities Program will have barriers established.

An uncontrolled subsea release to the marine environment has the potential to occur for either of the two production wells as well as the gas injection well, following accidental damage to, or removal of, a subsea Xmas tree (removing all barriers other than the SSSV) due to anchor drag or dropped object. With the absence of hydraulics to open the SSSV, a catastrophic full-bore blowout following removal or damage of an Xmas tree has been deemed not credible. Therefore, the only credible release is a leak past the closed TRSV flapper seal on the SSSV (note the TRSV is not designed to be fully sealing and has an acceptable leak rate), including the volume of system between the SSSV and Xmas tree.

An extended leak duration without detection is not considered credible. The force required to remove or damage a Xmas tree could only occur during a MODU activity, as a result of a dragged anchor or dropped object. If such a situation were to occur, an investigation would be performed and a response triggered immediately in the event of Xmas tree damage or removal. At worst, if damage to the well prohibited through-wellbore mitigation, a relief well would be required, this scenario would then result in an uncontrolled subsea well release for 67 days, which is the duration estimate from the start of the hydrocarbon release to the successful relief well kill. This results in a conservative release estimate of 5.76 m^3/day, plus the potential volume in the production tubing (from SSSV to the subsea tree which is 4.2 m^3), giving a total of 390 m^3 of Balnaves crude released over 67 days.

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Consequence Assessment
Potential Impacts Overview
Section 6.7.2 provides a detailed assessment of the potential impacts from a hydrocarbon release resulting in a loss of well control during well P&A, and describes potential impacts. Impacts from the credible worst-case hydrocarbon spill scenario that may arise from loss of well control due to accidental damage to, or removal of, a subsea Xmas tree (390 m^3) have been inferred from the loss of well containment during well P&A (14,113 m^3) (**Section 6.7.2**).This is considered to provide a highly conservative basis for assessing environmental impacts, given the nature and scale of the credible worst-case spill scenario resulting from accidental removal of the Xmas tree. The biological consequences of a release of Balnaves crude from the accidental removal of a Xmas tree on open water sensitive receptors relate to the potential for minor impacts to megafauna, plankton and fish populations (water column biota) in the vicinity of the Operational Area. Slight, short-term impacts to other users, such as commercial fishing or oil and gas operators are expected due to the expected localised extent of the spilled hydrocarbons.
Potential impacts to environmental values
In the unlikely event of an unplanned hydrocarbon release to the marine environment due to loss of well containment resulting from Xmas tree damage or removal, and given the adopted controls, it is considered that any potential impact would be minor and short-term in nature to water quality in comparison to background levels and/or international standards with minor and short-term impacts to habitats, populations and shipping/fishing concerns. The highest environmental consequence identified for the assessment of an unplanned hydrocarbon release to the marine environment due to loss of containment due to wellhead damage, as classified in **Table 2-3**, is defined as E, which equates to ‘slight, short-term impact (<1 year) on species, habitat (but not affecting ecosystem function), physical or biological attributes’. This scenario has a likelihood of highly unlikely, which takes into consideration the water depth (~110–160 m) and limited presence of third party marine users in the area. While the risk ranking of an undetected leak from a well is low, additional controls have been considered in order to reduce the overall timeframe of the leak scenario.

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				
Offshore Petroleum and Greenhouse Gas Storage (Resource Management and Administration) Regulations 2011: accepted WOMP. The WOMP describes describes the well integrity outcomes, control measures and performance criteria used to demonstrate how the risk of loss of well integrity is managed to ALARP including the well design and barriers to be used to prevent a loss of well integrity, which aligns with industry guidance and good practice.	F: Yes CS: Minimal cost. Standard practice.	Compliance with an accepted WOMP will ensure a number of barriers are in place and verified, reducing the likelihood of loss of well integrity occurring. Although the consequence of a blowout would not be reduced, the reduction in likelihood reduces the overall risk.	Control based on legislative requirements – must be adopted	Yes **C 9.2**
Good Practice				

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Demonstration of ALARP				
Control Considered	***Control Feasibility (F) and Cost/Sacrifice (CS)***[22]	***Benefit in Impact/Risk Reduction***	***Proportionality***	***Control Adopted***
Project specific Mooring Design Analysis.	F: Yes. CS: Standard practice. Required by Woodside standards.	Ensure adequate MODU station holding capacity to prevent loss of station keeping. This will reduce the likelihood of accidental damage to or removal of a Xmas tree resulting in release of hydrocarbons to the marine environment.	Benefits outweigh cost/sacrifice.	Yes **C 3.1**
In the event of a spill, emergency response activities implemented in accordance with the OPEP OPEP (per Table 7-4).	F: Yes. CS: Standard practice. Required by Woodside standards.	In the event of a loss of well containment, this control would not reduce the likelihood, but response activities may reduce the consquence.	Benefits outweigh cost/sacrifice.	Yes **C 11.1**
Arrangements supporting the activities in the OPEP (per Table 7-4) will be tested to ensure the OPEP can be implemented as planned.	F: Yes. CS: Standard practice. Required by Woodside standards.	Testing the OPEP activities would not reduce the likelihood, but response activities may reduce the consquence.	Benefits outweigh cost/sacrifice.	Yes **C 11.2**
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, **Section 2.6.1**), Woodside considers the adopted controls appropriate to manage the impacts and risks of loss of well containment from accidental damage to or removal of a Xmas tree. Note that Woodside has considered the impacts and risks of dropped objects, an event that may lead to Xmas tree removal, in **Section 6.7.11**. 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, loss of well containment from accidental damage to or removal of a Xmas tree represents a low current risk rating that is unlikely to result in a potential impact greater than localised, minor contamination resulting in a decrease in water quality, and the potential for slight, short-term (<1 year) impacts to marine fauna and habitat physical or biological attributes (but not affecting ecosystem function). Further opportunities to reduce the impacts and risks have been investigated above. The adopted controls are considered good oil-field practice/industry best practice. As demonstrated in **Section 6.7.2**, the residual risk of unplanned hydrocarbon release from loss of well containment is not inconsistent with the relevant objectives and actions of any applicable recovery plans or threat abatement plans, based on the adopted controls. Regard has been

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given to relevant conservation advice and wildlife conservation plans during the assessment of potential risks. 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 12 No loss of well containment resulting in loss of hydrocarbons to the marine environment from damage to or removal of a Xmas tree.	**C 9.2** Refer to **Section 6.6.7**	**PS 9.2** Refer to **Section 6.6.7.**	**MC 9.2.1** Refer to **Section 6.6.7**.
			MC 9.2.2 See **Section 6.6.7.**
	C 3.1 Refer to **Section 0**	**PS 3.1** Refer to **Section 0**	**MC 3.1.1** Refer to **Section 0**
	C 11.1 Refer to **Section 6.7.2**	**PS 11.1** Refer to **Section 6.7.2**	**MC 11.1.1** Refer to **Section 6.7.2**
	C 11.2 Refer to **Section 6.7.2**	**PS 11.2** Refer to **Section 6.7.2**	**MC 11.2.1** Refer to **Section 6.7.2**
Detailed preparedness and response performance outcomes, standards and measurement criteria for the Petroleum Activities Program are present in **Appendix D**.			

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6.7.4 Unplanned Hydrocarbon Release: Vessel Collision

Context		
Project vessels – **Section 3.8**	Physical environment – **Section 4.4** Biological environment **– Section 4.5** Socio-economic environment – **Section 4.6**	Stakeholder consultation – **Section 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
Loss of hydrocarbons to marine environment due to a vessel collision (e.g. support vessels or other marine users)			X		X	X	X	B	D	1	M	LCS GP PJ	Broadly Acceptable	EPO 13

Description of Source of Risk

Background

The temporary presence of the MODU and project vessels 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 MODU or a project vessel which could release hydrocarbons.

A moored MODU typically has a total marine diesel capacity of about 966 to 1400 m³ that are distributed through a number of isolated tanks. MODU fuel tanks are typically located on the inner sides of pontoons, and can be more than 10 m below the waterline.

A subsea support vessel typically has marine diesel storage distributed throughout the hull of the vessel. Individual fuel tanks range in size from 22-250 m^3 in volume.

The marine diesel storage capacity of a support vessel can also be in the order of 1000 m³ (total) that is distributed through multiple isolated tanks typically located mid-ship and can range in typical size from 22 to 105 m³.

In the unlikely event of a vessel collision involving the MODU during the Petroleum Activities Program, the MODU will have the capability to pump fuel from a ruptured tank to a tank with spare volume in order to reduce the potential volume of fuel released to the environment.

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, 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

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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 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 (**Table 6-12**). The scenarios considered damage to single and multiple fuel storage tanks in a project vessel and MODU due to dropped objects and various combinations of vessel to vessel and vessel to MODU collisions. In summary:

- It is not a credible scenario that the total storage volume of the MODU would be lost, as fuel is stored in more than one tank.
- It is not a credible scenario that a storage tank on the MODU would be damaged due to the location of the tanks within the hull, behind the bilge tanks, below the waterline.
- It is not a credible scenario that a collision between the support vessel and MODU would damage any storage tanks, due to the location of the tanks on both vessel types and secondary containment.
- It is highly unlikely that the full volume of the largest storage tank on a support vessel would be lost.

The last scenario considered was a collision between the support vessel with a third party vessel (i.e. commercial shipping, other petroleum related vessels and commercial fishing vessels). This was assessed as being credible but highly unlikely, given the standard vessel operations and equipment in place to prevent collision at sea, the standby role of a support vessel (low vessel speed) and its operation in close proximity to the MODU (exclusion areas), and the construction and placement of storage tanks. The largest tank of the support vessel is unlikely to exceed 105 m³.

Given the offshore location of the Operational Area, vessel grounding is not considered a credible risk.

Table 6-12: Summary of credible hydrocarbon spill scenario as a result of vessel collision

Scenario	Hydrocarbon Volumes	Preventative and Mitigation Controls	Credibility
Breach of MODU fuel tanks due to support vessel collision.	MODU has a fuel oil storage capacity of about 966 to 1400 m³, distributed through multiple tanks.	Fuel tanks are located on the inside of pontoons and protected by location below water line, protection from other tanks, e.g. bilge tanks. The draught of vessel and location of tanks in terms of water line prevent the tanks from being breached.	Not credible Due to location of tanks.
Breach of support vessel fuel tanks due to collision with MODU.	Activity support vessel has multiple marine diesel tanks typically ranging between 22 to 105 m³ each.	Typically, double wall tanks that are located mid ship (not bow or stern). Slow support vessel speeds when in proximity to MODU.	Not credible Collision with MODU at slow speeds is highly unlikely and, if it did occur, is highly unlikely to result in a breach of support vessel (low energy contact from slow moving vessel).
Breach of project support vessel fuel tanks due to support vessel – other vessel collision including	Activity support vessel has multiple marine diesel tanks typically ranging between 22 to 105 m³ each.	Typically, double wall tanks that are located midship (not bow or stern). Vessels are not anchored and steam at low speeds when	Credible Activity support vessel – other vessel collision could potentially result in

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commercial shipping/fisheries.		relocating within the Operational Area or providing stand-by cover. Normal maritime procedures would apply during such vessel movements.	the release from a fuel tank.
Loss of well control due to third party vessel (e.g. large bulk carrier) collision with MODU during permanent plugging for abandonment activities.	Loss of containment of reservoir fluids – see **Section 6.7.2** for estimated volumes.	Refer to **Section 6.7.2** for mitigation controls.	Credible See **Section 6.7.2**.
Dropped object from back-loading/offloading operations rupturing the MODU fuel tanks (e.g. a container or piece of equipment).	MODU has a fuel oil storage capacity of about 966 to 1400 m³, distributed through multiple tanks.	Fuel tanks are located on the inside of pontoons and protected by location below water line, protection from other tanks, e.g. bilge tanks. The draught of vessel and location of tanks in terms of water line prevent the tanks from being breached.	Not credible No direct pathway to tanks from dropped objects.

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 lies within the Operational Area and is located about 51 km north-west of the Montebello Islands. The modelled spill volume of 550 m^3 is greater than the worst-case credible release volume of 250 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 250 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 6-3**) (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 6-13**.

Table 6-13: 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

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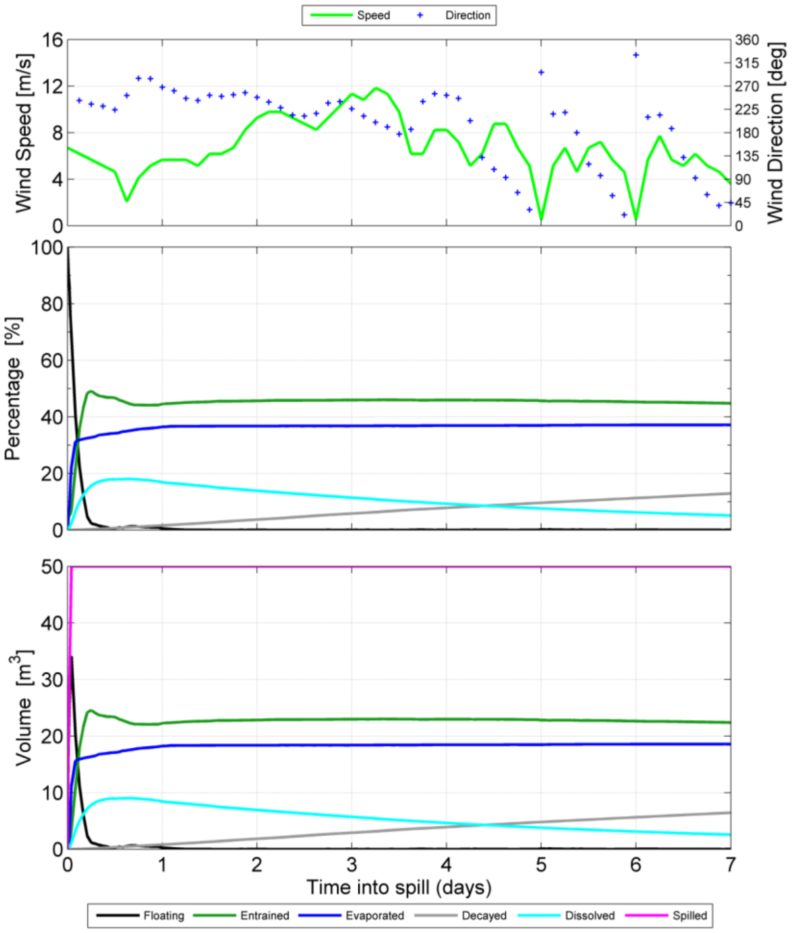

Figure 6-3: Proportional mass balance plot representing weathering of a surface spill of marine diesel as a one-off release (50 m^3 over 1 hour) and subject to variable wind at 27 °C water temperature and 25 °C air temperature (RPS, 2019)

Consequence Assessment

Potential Impacts Overview

Environment that May Be Affected

Surface Hydrocarbons: Quantitative hydrocarbon spill modelling results for surface hydrocarbons are shown in **Table 6-14**. 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 6-14**. 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 100 ppb are restricted to offshore areas up to about 400 km from the release site. **Table 6-14** provides details of receptors potentially contacted by entrained diesel at 100 ppb.

Dissolved Hydrocarbons: Dissolved aromatic hydrocarbons at concentrations equal to or greater than the 50 ppb threshold are predicted to be limited to the vicinity of the spill site (**Table 6-14**).

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

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Taking into consideration the EMBA derived from hydrocarbon spill modelling for a marine diesel spill, the environment that may be affected will fall within the EMBA of the spill from a loss of well integrity outlined in **Section 6.7.2**.

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Table 6-14: 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					
		Physical		Biological																				Socio-economic and Cultural										
		Water Quality	Sediment Quality	Marine Primary Producers			Other Communities/Habitats								Protected Species									Other Species							Socio-cultural EMBA		Ecological EMBA			
		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)	Sea snakes	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)	Accumulated hydrocarbons (10–100 g/m2)	Surface hydrocarbon (≥10 g/m²)	Entrained hydrocarbon (≥100 ppb)	Dissolved aromatic hydrocarbon (≥50 ppb)	Accumulated hydrocarbons (>100 g/m²)
Offshore	Montebello AMP	✓	✓	✓			✓	✓							✓	✓			✓	✓	✓	✓	✓	✓	✓	✓		✓	✓*		12	-	9	11	1	-
	Gascoyne AMP	✓	✓												✓	✓			✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	-	-	-	2	-	-
	Argo-Rowley Terrace AMP	✓						✓							✓	✓			✓			✓	✓	✓		✓			✓		-	-	-	1	-	-
Submerged Shoals	Rankin Bank	✓	✓	✓			✓	✓		✓						✓				✓		✓		✓	✓	✓		✓			1	-	-	2	-	-
Mainland (nearshore waters)	Ningaloo Coast (Middle, Middle WHA)	✓	✓	✓	✓	✓	✓	✓		✓		✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓		✓	✓		-	1-	-	1	-	-
	Ningaloo Coast (North WHA, South WHA) Ningaloo RUZ	✓	✓	✓	✓	✓	✓	✓		✓		✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓		✓	✓		-	-	-	1	-	-

Summary of Potential Impacts to Protected Species, Other Habitats and Communities, Water Quality and Socio-economic Values

Modelling of a 550 m³ release of marine diesel spill due to vessel collision predicts that no receptors will be contacted by accumulated oil concentrations equal to or greater than 100 g/m².

The Montebello AMP would have a very low probability (1%) of being contacted by dissolved aromatic hydrocarbons >50 ppb.

Entrained hydrocarbons >100 ppb are predicted to have a very low probability of contact with the outer boundaries of the Montebello AMP, Argo-Rowley Terrace AMP and Gascoyne AMP in open waters (1-11% probability of contact), the submerged shoals of Ranking Bank (2% probability of contact) and open waters of the Ningaloo Coast (Middle, Middle WHA, North WHA, South WHA) and Ningaloo RUZ (1% probability of contact for each). Surface hydrocarbons are predicted to have a 12% probability of contact with the outer boundary of the Montebello AMP in open waters and a 1% probability of contact at the submerged shoals of Ranking Bank at or above 1 g/m^2, and a 9 % probability at or above 10 g/m^2 at the Montebello AMP. Further, hydrocarbons reaching these environments will be highly weathered, with the volatile and water soluble (often the most toxic) components expected to have dissipated.

The potential impacts of spilled hydrocarbons to species (protected and otherwise), marine primary producers, other habitats and communities, water quality, marine sediment quality, air quality, protected areas and socio-economic values are described in **Section 6.7.2**. The loss of well integrity EMBA is larger spatially than the marine diesel EMBA; therefore, the potential impacts of entrained hydrocarbons provided in **Section 6.7.2**, and the scale of impact described, provides a conservative assessment for potential impacts of a 550 m³ release of marine diesel. Impacts specific to a spill of marine diesel are summarised below. It is noted that the toxic components in marine diesel include alkylated naphthalenes which can be rapidly accumulated by marine biota including invertebrates such as marine oysters, clams, shrimp, as well as a range of vertebrates, such as finfish. Marine diesel also contains additives that contribute to its toxicity.

Given the localised area of the potential EMBA and the rapid dispersion, dilution and weathering of a marine diesel spill, it is expected that any potential impacts will be low magnitude and temporary in nature.

Protected Species

As identified in **Section 4.5.2**, protected species including migrating pygmy blue whales and humpback whales may be encountered near the Operational Area, and therefore could be impacted in close proximity to the marine diesel spill location, where the volatile, water soluble and most toxic components of the diesel may be present. However, the window for exposure to hydrocarbons with the potential for any toxicity effects in these waters would be limited to a few days following the spill. Potential impacts may 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, organ or neurological damage leading to death. Given the absence of critical habitats or aggregation areas, cetaceans in the area are expected to be transient, and impacts are expected to be limited to individuals or small groups of animals. Impact on the overall population viability of cetaceans are not predicted.

The EMBA overlaps with habitat critical to the survival of flatback turtles for internesting and BIAs identified in Sec **Section 4.5.2.2**, particularly the internesting BIAs for flatback turtles which extend for ~80 km from known nesting locations. The Operational Area also overlaps with an internesting BIA for flatback turtles and designated habitat critical to the survival of flatback turtles for internesting at the Montebello Islands (with peak nesting in December and January). However, it is noted that the BIA and habitat critical to the survival of flatback turtles are considered very conservative as they are based on the maximum range of internesting females and many turtles are more likely to remain near their nesting beaches. 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 100 ppb respectively) will be present in offshore waters extending up to 85 km and 400 km respectively, from the release site. 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 50 ppb threshold are predicted to be limited to the vicinity of the spill site. Low concentrations are only capable of causing sublethal impacts to the most sensitive marine organisms and no lethal or sub-lethal impacts to marine turtles are expected in the BIAs. The potential for lethal and sub-lethal impacts to marine turtles is limited to small numbers of transient individuals that may be present in offshore waters near the release location.

Seabirds may also be exposed to marine diesel on the sea surface or upper water column, if resting or foraging in waters near to the spill. Impacts may include mortality due to oiling of feathers or the ingestion of hydrocarbons. However, due to the limited spatial extent of a marine diesel spill and limited window for exposure, population level impacts are not expected.

Other protected species that may occasionally transit through the area and may potentially be exposed to a marine diesel spill, include shark and ray species such as whale sharks and manta rays. The EMBA overlaps the whale shark foraging BIA along the North-west shelf, but does not overlap the foraging (high density prey) BIA along the Ningaloo coast. Should sharks or rays be present in offshore waters near the Operational Area during the spill, direct impacts may occur if foraging within surface slicks or in the upper 20 to 30 m of the water column containing entrained hydrocarbons and dissolved aromatics. Contamination of their food supply and the subsequent ingestion of this prey

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may also result in long term impacts as a result of bioaccumulation. Impacts are again predicted to be limited to a small number of animals given the low numbers of animals that may transit through the area during the short period when spilled hydrocarbons are present.

Given the limited number of animals that may be impacted and the rapid dispersion of marine diesel, it is considered that any potential impacts will be minor.

Other Habitats, Species and Communities

Within the EMBA for a marine diesel spill resulting from a vessel collision, there is the potential for plankton communities to potentially be impacted where entrained or dissolved hydrocarbon threshold concentrations are exceeded. A range of lethal and sublethal impacts may occur to plankton exposed to entrained or dissolved hydrocarbons within the EMBA. Communities are expected to recover quickly (weeks/months) due to high population turnover (ITOPF, 2011a). It is therefore considered that any potential impacts would be low magnitude and temporary in nature.

Pelagic fish populations in the open water offshore environment of the EMBA are highly mobile and have the ability to move away from a marine diesel spill. The spill-affected area would be confined to the surface layer and upper 20 to 30 m of the water column. It is therefore unlikely that fish populations would be exposed to widespread hydrocarbon contamination. Pelagic fish populations are distributed over a wide geographical area so impacts on populations or species level are considered to be negligible. Combined with these factors and the rapid dispersion of marine diesel, it is considered that any potential impacts will be minor.

Other communities (e.g. demersal fish, benthic infauna and epifauna) and key sensitivities (e.g. KEFs identified in **Section 4.5.3)** occur within the EMBA, however they will not be directly exposed or impacted by a marine diesel spill as hydrocarbons are confined to the upper layers of the water column.

Water Quality

It is likely that water quality will be reduced at the release location of the spill; however, such impacts to water quality would be temporary and localised in nature due to the rapid dispersion and weathering of marine diesel. The potential impact is therefore expected to be low.

Protected Areas

Surface, entrained and dissolved hydrocarbons at or exceeding impact thresholds have a low probability of contacting the outer boundaries of the Montebello AMP. The Gascoyne AMP, Argo-Rowley Terrace AMP, the submerged shoals of Rankin Bank as well as open waters of the Ningaloo Coast (Middle, Middle WHA, North WHA, South WHA and RUZ) also have a low probability of being affected by entrained hydrocarbons. Surface and entrained hydrocarbons are mostly only predicted within the deep open waters of these protected areas, with minimal overlap and no contact to seabed habitats or to shorelines above the ecological impact threshold values. Potential impacts to water quality and the natural values (e.g. mobile protected species) in these areas would be temporary and localised in nature due to the rapid dispersion and weathering of the marine diesel, as described above. Dissolved hydrocarbons (at or exceeding 50 ppb) are not predicted to reach any protected areas.

Socio-economic

A marine diesel spill is considered unlikely to cause significant direct impacts on the target species fished by Commonwealth and State fisheries (see **Section 4.6.2**) which overlap with the EMBA. The fisheries that operate within the EMBA predominantly target demersal fish species (demersal finfish and crustaceans) that inhabit waters in the range of >60–200 m depth, or pelagic species which are highly mobile. Therefore, a marine diesel spill is expected to only result in negligible impacts, considering that hydrocarbons are confined to the upper layers of the water column. Visible surface hydrocarbons at or exceeding 1 g/m^2 may also occur up to 180 km from the release site, which may result in fouling of fishing gear and a perception of impacts to fish stocks by fisheries stakeholders and the public. There is the potential that a fishing exclusion zone would be applied in the area of the spill, which would put a temporary ban on fishing activities and therefore potentially lead to subsequent economic impacts on commercial fishing operators if they were planning to fish within the area of the spill. Such measures would likely be in place for less than a week and would not result in widespread or long term impacts to fishing activities.

Summary of Potential Impacts to Environmental Values

In the unlikely event of an unplanned hydrocarbon release to the marine environment due to vessel collision, combined with the adopted controls, it is considered that any potential impact to water quality would be minor, localised and temporary in nature in comparison to background levels and/or international standards, with localised and temporary impacts to habitats, populations and shipping/fishing concerns.

The highest environmental consequence identified for the assessment of an unplanned hydrocarbon release to the marine environment due to vessel collision, as classified in **Table 2-3,** 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.

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Demonstration of ALARP				
Control Considered	***Control Feasibility (F) and Cost/Sacrifice (CS)***[23]	***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 13.1**
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) • 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.	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 13.2**
Establishment of a 500 m safety exclusion zone around MODU and communicated to marine users.	F: Yes. CS: Minimal cost. Standard practice.	Legislative requirements to be followed reduce the likelihood of a collision with a third party vessel.	Controls based on legislative requirements – must be adopted.	Yes **C 13.3**
Good Practice				
When a support vessel is designated for standby it will undertake actions to prevent unplanned interactions, such as: • Maintain a 24 hour radio watch on designated radio channel(s).	F: Yes. CS: Minimal cost – support vessels available routinely in Operational Area during Petroleum	Provides a reduction in likelihood of a collision with a third party vessel.	Benefits outweigh cost/sacrifice.	Yes **C 13.4**

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[23] Qualitative measure

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Demonstration of ALARP				
Control Considered	***Control Feasibility (F) and Cost/Sacrifice (CS)^{23}***	***Benefit in Impact/ Risk Reduction***	***Proportionality***	***Control Adopted***
• Perform continuous surveillance and warn the MODU of any approaching vessels reaching 500 m petroleum safety zone. Surveillance shall be conducted by a combination of: – visual lookout – radar watch – other electronic systems available including AIS – monitoring any additional/agreed radio communications channels – all other means available. • While complying with Convention on the International Regulations for Preventing Collisions at Sea, 1972 (COLREGS), approach any vessel attempting to transit through the 500 m zone and contact vessel by all available means. • Monitor and advise the MODU if: – MODU navigation signals are defective – visibility becomes restricted. • Advise if any buoys in the area are not holding position or are not working as expected.	Activities Program. Standard practice.			
AHO notified of activities and movements no less than four working weeks prior to scheduled activity commencement date of permanent plugging and infrastructure removal activities.	F: Yes. CS: Minimal cost. Standard practice.	Notification to AHO 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 upon commencement and completion of permanent plugging and infrastructure removal activities.	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	Benefits outweigh cost/sacrifice. Control is also Standard Practice.	Yes **C 1.3**

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Demonstration of ALARP				
Control Considered	***Control Feasibility (F) and Cost/Sacrifice (CS)***[23]	***Benefit in Impact/ Risk Reduction***	***Proportionality***	***Control Adopted***
		collision with a third party vessel.		
Notify AHO and AMSA JRCC of any extended delay in the timing of the Petroleum Activities Program.	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 1.4**
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.				
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, **Section 2.6.1**), 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.				

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Demonstration of Acceptability
Acceptability Statement The impact assessment has determined that an accidental hydrocarbon release as a result of a vessel collision represents a moderate current risk rating and may result in minor, short-term impact (1-2 years) on species, habitat (but not affecting ecosystems function), physical or biological attributes and communities. BIAs within the Operational Area include flatback turtle internesting, whale shark foraging, and wedge-tailed shearwater breeding BIA. Relevant recovery plans and conservation advice have been considered during the impact assessment, and the Petroleum Activities Program is not considered to be inconsistent with the overall recovery objectives and actions of these recovery plans and conservation advice. The adopted controls are considered consistent with industry legislation, codes and standards, good practice and professional judgement and meet the requirements and expectations of Australian Marine Orders, AMSA and AHO identified during impact assessment and stakeholder consultation. On the basis of the environmental impact assessment outcomes and Woodside's criteria for acceptability outlined in **Section 2.7.2,** this is considered an acceptable level of risk.

Environmental Performance Outcomes, Standards and Measurement Criteria			
Outcomes	***Controls***	***Standards***	***Measurement Criteria***
EPO 13 No release of hydrocarbons to the marine environment due to a vessel collision during the Petroleum activities Program.	**C 13.1** 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 13.1** Support vessels and MODU compliant with Marine Order 30 (which requires vessels to be visible at all times) to prevent unplanned interaction with marine users.	**MC 13.1.1** Marine Assurance inspection records demonstrate compliance with standard maritime safety procedures (Marine Orders 21 and 30).
	C 13.2 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) • 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.	**PS 13.2** Support vessels and MODU compliant with Marine Order 21 to prevent unplanned interaction with marine users.	

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Environmental Performance Outcomes, Standards and Measurement Criteria			
Outcomes	***Controls***	***Standards***	***Measurement Criteria***
	C 13.3 Establishment of a 500 m safety exclusion zone around MODU/infrastructure removal vessel and communicated to marine users.	**PS 13.3** No adverse interactions between vessels and MODU.	**MC 13.3.1** Records demonstrate breaches by unauthorised vessels within the petroleum safety zone are recorded.
			MC 13.3.2 Consultation records demonstrate that AHO has been notified before commencing the activity to allow generation of navigation warnings (MSIN and NTM (including AUSCOAST warnings where relevant)), which communicate safety exclusion zones to marine users.
	C 13.4 When a support vessel is designated for standby it will undertake actions to prevent unplanned interactions, such as: • Maintain a 24 hour radio watch on designated radio channel(s). • Perform continuous surveillance and warn the MODU of any approaching vessels reaching the 500 m petroleum safety zone. Surveillance shall be conducted by a combination of: – visual lookout – radar watch – other electronic systems available including AIS – monitoring any additional/agreed radio communications channels – all other means available. • While complying with COLREGS, approach any vessel attempting to transit through the 500 m zone and contact vessel by all available means. • Monitor and advise the MODU if:	**PS 13.4** Define role of support vessels in maintaining petroleum safety zone, preventing unplanned third party vessel interactions, monitoring the effectiveness of navigation controls (e.g. signals), and warning third party vessels of navigation hazards.	**MC 13.4.1** Records of non-conformance against controls maintained.

Environmental Performance Outcomes, Standards and Measurement Criteria			
Outcomes	***Controls***	***Standards***	***Measurement Criteria***
	– MODU navigation signals are defective – visibility becomes restricted. • Advise if any buoys in the area are not holding position or are not working as expected.		
	C 1.1 Notify AHO of activities and movements no less than four working weeks before prior to the scheduled activity commencement date of permanent plugging and infrastructure removal activities.	**PS 1.1** Notification to AHO 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 AHO has been notified before commencing of permanent plugging and infrastructure removal activities to allow generation of navigation warnings (MSIN and NTM (including AUSCOAST warnings where relevant)), which communicate safety exclusion zones to marine users.
	C 1.3 Notify AMSA JRCC for the permanent plugging and infrastructure removal activities: • 24-48 hrs before operations commence • when operations start • When operations end	**PS 1.3** Notification to AMSA JRCC to prevent activities interfering with other marine users. AMSA's JRCC will require the MODU's details (including name, callsign and Maritime Mobile Service Identity), 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 within required timeframes.
	C 1.4 Notify AHO and AMSA JRCC of any extended delay in the timing of the Petroleum Activities Program.	**PS 1.4** AHO and AMSA JRCC notified of any extended delay in the timing of the Petroleum Activities Program.	**MC 1.4.1** Consultation records demonstrate that AHO and AMSA JRCC were notified of extended delays in the timing of the Petroleum Activities Program.
Detailed preparedness and response performance outcomes, standards and measurement criteria for the Petroleum Activities Program are presented in **Appendix D.**			

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6.7.5 Unplanned Hydrocarbon or Chemical Release: Hydrocarbon Release during Bunkering/Refuelling and Chemical Transfer, Storage and Use

Context		
Project Vessels – **Section 3.8**	Physical Environment – **Section 4.4** Biological Environment – **Section 4.5**	Stakeholder Consultation – **Section 5**

Risk Evaluation Summary														
Source of Risk	***Environmental Value Potentially Impacted***							***Evaluation***						
	Soil and Groundwater	Marine Sediment	Water Quality	Air Quality (incl Odour)	Ecosystems/ Habitat	Species	Socioeconomic	Decision Type	Consequence/Impact	Likelihood	Risk Rating	ALARP Tools	Acceptability	Outcome
Loss of hydrocarbons (diesel/jet fuel) to marine environment from bunkering/ refuelling			X			X		A	E	2	M	LCS GP PJ	Broadly Acceptable	EPO 14

Description of Source of Risk

Bunkering of marine diesel between the support vessel(s) and the MODU may occur in the Operational Area. Additionally, refuelling of helicopters using aviation jet fuel may occur onboard the MODU. Other fuel transfers that may occur within the Operational Area include refuelling of cranes or other equipment as required. There is no planned bunkering of support vessels.

Three credible scenarios for the loss of containment of marine diesel during bunkering operations were identified:

Partial or total failure of a bulk transfer hose or fittings during bunkering, due to operational stress or other integrity issues, could spill marine diesel to the deck and/or into the marine environment. This would be in the order of less than 200 L, based on the likely volume of a bulk transfer hose (assuming a failure of the dry break coupling and complete loss of hose volume).

Partial or total failure of a bulk transfer hose or fittings during bunkering, combined with a failure in procedure to shut off fuel pumps, for a period of up to five minutes, could result in about 8 m^3 marine diesel loss to the deck and/or into the marine environment.

Partial or total failure of a bulk transfer hose or fittings during helicopter refuelling could spill aviation jet fuel to the helicopter deck and/or into the marine environment. All helicopter refuelling activities are closely supervised and leaks on the helideck are considered to be easily detectable. In the event of a leak, transfer would cease immediately. The credible volume of such a release during helicopter refuelling would be in the order of less than 100 L.

Likelihood

The likelihood of 2 ‘Unlikely’ corresponds to ‘Has occurred many times in the industry but not at Woodside’.

A search of the Woodside spill records indicates that, while there have been smaller releases (less than 30 L) associated with bunkering, there have been no recorded partial or total failures of bulk transfer hose or fittings during bunkering, combined with a failure in procedure to shut off fuel pumps for a period of up to five minutes, resulting in the worst-case credible scenario of an 8 m^3 loss of diesel.

ITOPF Limited (IOTPF) (2018) data reports that for tanker operations during 1970 to 2017, 7% of small (more than seven tonnes) spills occurred during bunkering and 2% of medium (seven to 700 tonnes) spills. While this data is from the oil tanker industry, it has been used as an indicator of the potential for spills associated with bunkering activities. A risk assessment by AMSA of oil spills in Australian ports and waters (Det Norske Veritas, 2011) identifies transfer spills as a risk.

Quantitative Spill Risk Assessment

Woodside has commissioned RPS to model several small marine diesel spills, including surface spill volumes of 8 m^3 in the offshore waters of north-west WA. The results of these models have indicated that exposure to surface hydrocarbons above the 10 g/m^2 threshold is limited to the immediate vicinity of the release site, with little potential to extend beyond 1 km. Therefore, it is considered that exposure to threshold concentrations from an 8 m^3 surface spill from bunkering activities would be well within the EMBA for the vessel collision scenario detailed in **Section 6.7.4.** Given this, the offshore location of the Operational Area, and the fact that the same hydrocarbon type is involved for both scenarios, specific modelling for an 8 m^3 marine diesel release was not performed for this Petroleum Activities Program.

Given the physical and chemical similarities, and the relatively small credible spill volumes, marine diesel is considered to be a suitable substitute for aviation jet fuel for the purposes of this environmental risk assessment. Aviation jet fuel would behave similarly to diesel and have similar impacts and, considering small size of spill volumes likely to be contained on the helideck, this has not been modelled.

Hydrocarbon Characteristics

Refer to **Section 6.7.4** for a description of the characteristics of marine diesel, including detail on the predicted fate and weathering of a spill to the marine environment.

Consequence Assessment

Potential Consequence Overview

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Previous modelling studies for 8 m^3 marine diesel releases, spilled at the surface as a result of bunkering activities, indicated that the potential for exposure to surface hydrocarbons exceeding 10 g/m^2 was confined to within the immediate vicinity (about 1 km) of the release sites. Therefore, it is considered that there is no potential for contact with sensitive receptor locations above surface (10 g/m^2), entrained (100 ppb) or dissolved (50 ppb) threshold concentrations from an 8 m^3 spill of marine diesel within the Operational Area.

Summary of Potential Impacts to Environmental Value(s)

The potential biological and ecological impacts associated with much larger hydrocarbon spills are presented in **Section 6.7.2** and **Section 6.7.4**; further detail on impacts specific to a spill of marine diesel from a bunkering loss are provided below.

The biological consequences of such a small volume spill on identified open water sensitive receptors relate to the potential for slight, short-term impacts to megafauna, plankton and fish populations (surface and water column biota) that are within the spill-affected area. No impacts to commercial fisheries are expected. Refer to **Section 6.7.4** for the detailed potential impacts of unplanned hydrocarbon release to the marine environment from vessel collision. However, the extent of the EMBA associated with a marine diesel spill from loss during bunkering will be much reduced in terms of spatial and temporal scales; hence, potential impacts from bunkering are considered slight.

Demonstration of ALARP

Control Considered	***Control Feasibility (F) and Cost/Sacrifice (CS)[24]***	***Benefit in Impact/Risk Reduction***	***Proportionality***	***Control Adopted***
Legislation, Codes and Standards				
Marine Order 91 (Marine pollution prevention – oil) 2014, requires Ship Oil Pollution Emergency Plan (SOPEP)/Spill Monitoring Programme Execution Plan (SMPEP) (as appropriate to vessel class).	F: Yes. CS: Minimal cost. Standard practice.	By ensuring a SOPEP/SMPEP is in place for the vessel, the likelihood of a spill entering the marine environment is reduced. Although no significant reduction in consequence could result, the overall risk is reduced.	Controls based on legislative requirements – must be adopted.	Yes **C 14.1**
Good Practice				
Bunkering equipment controls: • All hoses that have a potential environmental risk following damage or failure shall be linked to the MODU's preventative maintenance system. • All bulk transfer hoses shall be tested for integrity before use (tested in accordance with Original Equipment Manufacturer recommendations) and re-certified annually as a minimum.	F: Yes. CS: Minimal cost. Standard practice.	Reduces the likelihood of a spill occurring. Although no significant reduction in consequence could result, the overall risk is reduced.	Benefits outweigh cost/sacrifice.	Yes **C 14.2**

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[24] Qualitative measure

• There shall be dry-break couplings and flotation on fuel hoses. • There shall be an adequate number of appropriately stocked, located and maintained spill kits.				
Contractor procedures include requirements to be implemented during bunkering/refuelling operations, including: • A completed PTW and/or Job Safety Assessment (JSA) shall be implemented for the hydrocarbon bunkering/refuelling operation. • Visual monitoring of Gauges, hoses, fittings and the sea surface during the operation. • Hose checks prior to commencement. • Bunkering/refuelling will commence in daylight hours. If the transfer is to continue into darkness, the JSA risk assessment must consider lighting and the ability to determine if a spill has occurred. • Hydrocarbons shall not be transferred in marginal weather conditions.	F: Yes. CS: Minimal cost. Standard practice.	Reduces the likelihood of a spill occurring. Although no significant reduction in consequence could result, the overall risk is reduced.	Benefits outweigh cost/sacrifice.	Yes **C 14.3**
Mitigation: Oil spill response.	Refer to **Appendix D**.			
Professional Judgement – Eliminate				
No refuelling of helicopter on MODU.	F: No. Given the distance of the Operational Area from the airports suitable for helicopter operations, and the endurance of available helicopters, eliminating helicopter refuelling is not feasible. Helicopter flights cannot be eliminated, and may be required in emergency situations.	Not considered, control not feasible.	Not considered, control not feasible.	No

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	CS: Not assessed, control cannot feasibly be implemented.			
The MODU brought into port to refuel.	F: No. Does not eliminate the fuel transfer risk. It is not operationally practical to transit MODU back to port for refuelling, based on the frequency of the refuelling requirements and distance from the nearest port (Dampier approximately 180 km southeast). CS: Significant due to schedule delay and vessel transit costs and day rates.	Eliminates the risk in the Operational Area. However, moves risk to another location. Therefore, no overall benefit.	Disproportionate. The cost/ sacrifice outweighs the benefit gained.	No
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, **Section 2.6.1**), Woodside considers the adopted controls appropriate to manage the risks and consequences of a bunkering spill. As no reasonable additional/alternative controls were identified that would further reduce the risks and consequences without grossly disproportionate sacrifice, the risks and consequences are considered ALARP.

Demonstration of Acceptability

Acceptability Statement

Loss of hydrocarbons to marine environment during bunkering has been evaluated as having a low moderate risk rating and may result in slight, short-term impacts (<1 year) on species, habitat (but not affecting ecosystems function) or biological attributes. Relevant management plans and species recovery plans and conservation advice have been considered during the impact assessment and, given the adopted controls, the Petroleum Activities Program is not considered to be inconsistent with the overall objectives and actions of these plans.

The adopted controls are considered consistent with industry legislation, codes and standards, good practice and professional judgement and meet the requirements of Australian Marine Orders. On the basis of the environmental impact assessment outcomes and Woodside's criteria for acceptability outlined in **Section 2.7.2**, this is considered an acceptable level of risk.

Environmental Performance Outcomes, Standards and Measurement Criteria

Outcomes	***Controls***	***Standards***	***Measurement Criteria***
EPO 14 No unplanned loss of hydrocarbons to the marine environment from bunkering greater than a	**C 14.1** Marine Order 91 (Marine pollution prevention – oil) 2014, requires SOPEP/SMPEP (as	**PS 14.1** Appropriate initial responses prearranged and exercised for response to a hydrocarbon spill, as appropriate to vessel class.	**MC 14.1.1** Marine Assurance inspection records demonstrate compliance with Marine Order 91.

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consequence level of E[25] during the Petroleum Activities Program. Detailed oil spill preparedness and response performance outcomes, standards and MC for the Petroleum Activities Program are presented in **Appendix D.**	appropriate to vessel class).		
	C 14.2 Bunkering equipment controls: • All hoses that have a potential environmental risk following damage or failure shall be placed on the MODU's preventative maintenance system. • All bulk transfer hoses shall be tested for integrity before use (tested in accordance with Original Equipment Manufacturer recommendations and re-certified annually as a minimum). • There shall be dry-break couplings and flotation on fuel hoses. • There shall be an adequate number of appropriately stocked, located and maintained spill kits.	**PS 14.2.1** Equipment identified as having integrity damage is replaced prior to failure.	**MC 14.2.1** Records confirm the MODU bunkering equipment is subject to systematic integrity checks.
		PS 14.2.2 Bunkering equipment controls employed during bunkering.	**MC 14.2.2** Records confirm presence of dry break of couplings and flotation on fuel hoses.
		PS 14.2.3 Spill kits available in the event of a spill during bunkering.	**MC 14.2.3** Records confirm presence of spill kits.

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[25] Defined as 'Slight, short-term local impact (less than one year), on species, habitat (but not affecting ecosystem function), physical or biological attributes'.

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	C 14.3 Contractor procedures include requirements to be implemented during bunkering/refuelling operations, including: • Implement a completed PTW and/or JSA for the hydrocarbon bunkering/refuelling operation. • Visually monitor gauges, hoses, fittings and the sea surface during the operation. • Check hoses prior to commencement. • Commence bunkering/ refuelling in daylight hours. If the transfer is to continue into darkness, the JSA risk assessment must consider lighting and the ability to determine if a spill has occurred. • Do not transfer hydrocarbons in marginal weather conditions.	**PS 14.3** Comply with Contractor procedures for managing bunkering/helicopter operations.	**MC 14.3.1** Records demonstrate bunkering/refuelling performed in accordance with contractor bunkering procedures.
Detailed oil spill preparedness and response performance outcomes, standards and MC for the Petroleum Activities Program are presented in **Appendix D**.			

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6.7.6 Unplanned Discharges: Drilling Fluids and Well Fluids

Context		
Project Vessels – **Section 3.8**	Physical Environment – **Section 4.4** Biological Environment – **Section 4.5**	Stakeholder Consultation – **Section 5**

Risk Evaluation Summary

Source of Risk	***Environmental Value Potentially Impacted***							***Evaluation***						
	Soil and Groundwater	Marine Sediment	Water Quality	Air Quality (incl Odour)	Ecosystems/ Habitat	Species	Socioeconomic	Decision Type	Consequence/Impact	Likelihood	Risk Rating	ALARP Tools	Acceptability	Outcome
Accidental discharge of drilling fluids (WBM/NWBM/base oil) to marine environment due to failure of slip joint packers, bulk transfer hose/fitting, emergency disconnect system or from routine MODU operations		X	X		X	X		A	E	2	M	LC S GP PJ	Broadly acceptable	EPO 15

Description of Source of Risk

Drilling Fluids - Transfers

A support vessel will bulk transfer WBM and NWBM/base oil to the MODU, if and when required. Failure of a transfer hose or fittings during a transfer or backload, as a result of an integrity or fatigue issue, could result in a spill of mud or base oil to either the bunded deck or into the marine environment.

The most likely spill volume of mud is likely to be less than 0.2 m³, based on the volume of the transfer hose and the immediate shutoff of the pumps by personnel involved in the bulk transfer process. However, the worst-case credible spill scenario could result in up to 8 m³ of mud being discharged. This scenario represents a complete failure of the bulk transfer hose combined with a failure to follow procedures, requiring transfer activities to be monitored, coupled with a failure to immediately shut off pumps (e.g. mud pumped through a failed transfer hose for a period of about five minutes).

Drilling Fluids - Slip Joint Packer Failure

The slip joint packer enables compensation for the dynamic movement of the MODU (heave) in relation to the static location of the BOP. A partial or total failure of the slip joint packer could result in a loss of mud to the marine environment. The likely causes of this failure include a loss of pressure in the pneumatic (primary) system combined with loss of pressure in the back-up (hydraulic) system.

Catastrophic sequential failure of both slip joint packers (pneumatic and hydraulic) would trigger the alarm and result in a loss of the volume of fluid above the slip joint (conservatively 1.5 m³), plus the volume of fluid lost in the one minute (maximum) taken to shut down the pumps. At a flow rate of 3.8 m³ per minute, this volume would equate to an additional 3.8 m³. In total, it is expected that this catastrophic failure would result in a loss of 5.3 m³.

Failure of either of the slip joint packers at a rate not large enough to trigger the alarms could result in an undetected loss of 20 bbl (3 m³) maximum, assuming a loss rate of 10 bbl/hr and that MODU personnel would likely walk past the moon pool at least every two hours.

Drilling Fluids - Activation of the Emergency Disconnect Sequence

The EDS is an emergency system that provides a rapid means of shutting in the well (i.e. BOP closed) and disconnecting the MODU from the BOP. The EDS could be manually activated due to an identified threat to the safety of the MODU, including loss of MODU station keeping resulting from loss of multiple moorings, potential collision by a third-party vessel or a loss of well control.

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During operations, this could result in a subsurface release of a combination of WBM and/or NWBM and solids at the seabed and a release of base fluid. The volume of material released depends on the water depth and, hence, the length of the riser (i.e. the entire riser volume would be lost). The base oil of the NWBM would remain in an emulsion with the other components of the mud system.

NWBM Drilling Fluid System

The selection of a NWBM drilling fluid system will be based on Woodside processes (as outlined in **Section 3.15**); however, for the purposes of this risk assessment, an example base oil (Saraline 185V) has been used. Saraline 185V is a mixture of volatile to low volatility hydrocarbons. Predicted weathering of base oil, based on typical conditions in the region, indicates that about 50% by mass is predicted to evaporate over the first day or two (refer to **Table 6-15**). At this time, most of the remainder could be entrained into the water column. In calm conditions, entrained hydrocarbons are likely to resurface with up to 100% able to evaporate over time.

Table 6-15: Characteristics of the non-water based mud base oil

Oil type	Initial density (kg/m^3)	Viscosity (cP @ 20 °C)	Volatiles (%) <180	Semi volatiles (%) 180–265	Low volatility (%) 265–380	Residual (%) >380	Aromatic (%) of whole oil <380 °C BP
Base oil (Saraline 185V)			***Non-Persistent***		***Persistent***		
	0.7760	2.0 @ 40 °C	8.5	41.1	50.4	0	0

Consequence Assessment

NWBM is made up of a number of components detailed in **Section 3.15.2**, including base oil, which generally has a high-volatile to semi-volatile fraction. If released to the marine environment at surface, the base oil generally evaporates within the first 48 hours, with the remaining fraction weathering at a slower rate. The worst-case scenario for NWBM being discharged at the surface results from an unplanned discharge of about 8 m^3 during bunkering and/or transfer activities. While discharge may also occur at the surface during a slip joint packer failure, the volume from this event is likely to result in a smaller discharge. As a result of volatility of NWBM, combined with the approximate credible volume of 8 m^3, and based on Woodside's experience of modelling base oil, it is considered there would be an extremely small footprint area associated with any release. Any surface oil would be confined to open waters, with a minor surface slick that would not reach any sensitive receptors. Therefore, impacts on water quality would be minor and temporary in nature.

The material safety datasheet for Saraline 185V indicates it is readily biodegradable, non-toxic in the water column and has low sediment toxicity (Shell, 2014). Marine fauna may be affected if they come in direct contact with a release (i.e. by traversing near the surface of the immediate spill area), but due to the small footprint of such a spill, it is anticipated that any impacts would be slight and temporary in nature.

NWBM may also be discharged to the seabed surrounding the well site during an EDS event. The footprint associated with releasing NWBM from the activation of the EDS would be small, and limited to deeper water seabed surrounding the well site (the release point). The environmental consequence of such a release would include a highly localised area at the discharge location. It is expected the weight of NWBM would result in most of the release settling to the seabed and/or remaining at depth within the water column. Impacts to the underlying infauna may occur but are considered unlikely and, if lethal impacts are observed, they would be limited in extent and recolonisation would occur over time. Elevated hydrocarbon and metal concentrations in the localised area of deposition would also occur, with reduction over time. It is likely that any impacts to water and sediment quality and low-sensitivity deeper water benthos would be slight, short-term, and a full recovery expected.

WBM is made up of the components detailed in **Section 3.15.2**, including a variety of chemicals with low toxicity, incorporated into the selected drilling fluid system to meet specific technical requirements. If released to the marine environment at the surface, there would be an extremely small impact footprint area. Any release would be confined to the open waters of the Operational Areas that would not reach any sensitive receptors. Components of the WBM would settle in the water column and be subject to dilution. Given the low toxicity of WBM, any impacts on water quality from unplanned discharges would be slight and short-term.

Summary of Potential Impacts to Environmental Value(s)

Given the adopted controls, it is considered that accidental discharge of NWBM/base oil or WBM will not result in a potential impact to protected species and water quality greater than E – Slight, with no significant impact on environmental receptors predicted. It is considered that the release of NWBM solids from an unplanned discharge will

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Consequence Assessment
not result in a potential impact greater than slight, short-term contamination above background levels, water quality standards, or known effect concentrations.

Demonstration of ALARP				
Control Considered	***Control Feasibility (F) and Cost/Sacrifice (CS)[26]***	***Benefit in Impact/Risk Reduction***	***Proportionality***	***Control Adopted***
Legislation, Codes and Standards				
Where there is potential for loss of primary containment of oil and chemicals on the MODU, deck drainage must be collected via a closed drainage system e.g. drill floor.	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 6.3**
Marine riser's telescopic joint to be: • comprised of a minimum of two packers (one hydraulic and one pneumatic) • pressure tested in accordance with manufacturer's recommendations.	F: Yes. CS: Minimal cost. Standard practice.	Reduces the likelihood of equipment failure leading to an unplanned release of drilling fluids. Although the consequence of an unplanned release would be reduced, the reduction in likelihood reduces the overall risk providing an overall environmental benefit.	Benefits outweigh cost/sacrifice.	Yes **C 15.1**
Good Practice				
Fluids and additives intended or likely to be discharged to the marine environment will have an environmental assessment completed before use.	F: Yes. CS: Minimal cost. Standard practice.	Reduces the consequence of impacts resulting from discharges to the marine environment by ensuring chemicals have been assessed for environmental acceptability. Planned discharges are required for safely executing activities; therefore, no reduction in likelihood can occur.	Benefits outweigh cost/sacrifice.	Yes **C 7.1**
Chemical reviews will be performed on all previously approved chemicals to confirm potential chemical impacts are reduced to ALARP.	F: Yes. CS: Minimal cost. Standard practice.	Reviews will ensure chemicals selected for drilling and completions fluids remain ALARP.	Benefits outweigh cost/sacrifice.	Yes **C 7.2**

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[26] Qualitative measure

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Demonstration of ALARP				
Control Considered	***Control Feasibility (F) and Cost/Sacrifice (CS)[26]***	***Benefit in Impact/Risk Reduction***	***Proportionality***	***Control Adopted***
Contractor procedure for managing drilling fluids transfers onto, around and off the MODU, which requires: • emergency shutdown systems for stopping losses of containment (e.g. burst hoses) • break-away dry-break couplings for NWBM hoses • transfer hoses to have flotation devised to allow detection of a leak • the valve line-up to be checked prior to commencing mud transfers • constant monitoring of the transfer process • direct radio communications • completed PTW and JSA showing contractor procedures are implemented • recording and verification of volumes moved to identify any losses • mud pit dump valves will be locked closed when not in use for mud transfers and operated under a PTW.	F: Yes. CS: Minimal cost. Standard practice for Woodside to review contractor systems prior to performing activity.	Reduces the likelihood of an unplanned release occurring. Although no change in consequence would occur, the reduction in likelihood decreases the overall risk, providing environmental benefit.	Benefits outweigh cost/sacrifice.	Yes **C 15.2**
Check the functionality of: • additional SCE (augers and cuttings dryers) • mud tanks • mud tank room • transfer hoses • NWBM base fluid transfer lines • NWBM base fluid transfer station • base fluid storage.	F: Yes. CS: Minimal cost. Standard practice	Reduces the likelihood of an event occurring and reduces the potential consequences (by limiting volume released).	Benefits outweigh cost/sacrifice.	Yes **C 15.3**
Professional Judgement – Eliminate				
No additional controls identified.				
Professional Judgement – Substitute				

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<table>
<tr><th colspan="5">Demonstration of ALARP</th></tr>
<tr><th><i>Control Considered</i></th><th><i>Control Feasibility (F) and Cost/Sacrifice (CS)[26]</i></th><th><i>Benefit in Impact/Risk Reduction</i></th><th><i>Proportionality</i></th><th><i>Control Adopted</i></th></tr>
<tr><td>Only use WBM.</td><td>F: Not feasible. Removal of NWBM from the B-annuli is required to achieve permanent abandonment of the Balnaves wells.
CS: Not considered – control not feasible.</td><td>Not considered, control not feasible.</td><td>Not considered, control not feasible.</td><td>No</td></tr>
<tr><td colspan="5"><i>Professional Judgement – Engineered Solution</i></td></tr>
<tr><td>Use a MODU that may have a larger tank storage capacity for WBM. As such, there would be fewer bulk transfer movements.</td><td>F: Not feasible. The use of a MODU with greater storage capacity cannot be confirmed.
CS: Significant cost and schedule delay would occur if the MODU was limited to greater storage capacity.</td><td>Not considered, control not feasible.</td><td>Not considered, control not feasible.</td><td>No</td></tr>
<tr><td colspan="5"><i>ALARP Statement</i>
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, Section 2.6.1), Woodside considers the adopted controls appropriate to manage the risks and consequences of the accidental discharge of drilling fluids, described above. As no reasonable additional/alternative controls were identified that would further reduce the risks and consequences without grossly disproportionate sacrifice, the risks and consequences are considered ALARP.</td></tr>
</table>

Demonstration of Acceptability
Acceptability Statement The impact assessment has determined that an unplanned discharge of drilling fluids represents a low current risk rating and may result in slight, short-term impacts (>1 year) on species, habitat (but not affecting ecosystems function) or biological attributes. BIAs within the Operational Area include flatback turtle internesting, whale shark foraging, and wedge-tailed shearwater breeding BIA. However, these species are not expected to be impacted. The adopted controls are considered consistent with industry legislation, codes and standards, good practice and professional judgement. On the basis of the environmental impact assessment outcomes and Woodside's criteria for acceptability outlined in **Section 2.7.2**, this is considered an acceptable level of risk.

<table>
<tr><th colspan="4">Environmental Performance Outcomes, Standards and Measurement Criteria</th></tr>
<tr><th><i>Outcomes</i></th><th><i>Controls</i></th><th><i>Standards</i></th><th><i>Measurement Criteria</i></th></tr>
<tr><td rowspan="3">EPO 15
No unplanned loss of WBM, NWBM or base oil greater than a consequence level E[27] during the Petroleum Activities Program.</td><td>C 6.3
See Section 6.6.4</td><td>PS 6.3
See Section 6.6.4</td><td>MC 6.3.1
See Section 6.6.4</td></tr>
<tr><td>C 7.1
See Section 6.6.5</td><td>PS 7.1
See Section 6.6.5</td><td>MC 7.1.1
See Section 6.6.5</td></tr>
<tr><td>C 7.2
See Section 6.6.5</td><td>PS 7.2
See Section 6.6.5</td><td>MC 7.2.1
See Section 6.6.5</td></tr>
</table>

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[27] Defined as 'Slight, short term local impact (less than one year), on species, habitat (but not affecting ecosystem function), physical or biological attributes'.

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Environmental Performance Outcomes, Standards and Measurement Criteria			
Outcomes	***Controls***	***Standards***	***Measurement Criteria***
	C 15.1 Marine riser's telescopic joint to be: • comprised of a minimum of two packers (one hydraulic and one pneumatic) • pressure tested in accordance with manufacturer's recommendations.	**C 15.1** MODU's joint packer designed and maintained to reduce hydrocarbons discharged to the environment.	**C 15.1.1** Records demonstrate that MODU's joint packer is compliant.
	C 15.2 Contractor procedure for managing drilling fluids transfers onto, around and off the MODU, which requires: • emergency shutdown systems for stopping losses of containment (e.g. burst hoses) • break-away dry-break couplings for NWBM hoses • transfer hoses to have flotation devised to allow detection of a leak • the valve line-up to be checked before commencing mud transfers • constant monitoring of the transfer process • direct radio communications • completed PTW and JSA showing contractor procedures are implemented • recording and verification of volumes moved to identify any losses • mud pit dump valves to be locked closed when not in use for mud transfers and operated under a PTW.	**PS 15.2** Compliance with contractor procedures to limit accidental loss to the marine environment.	**MC 15.2.1** Records demonstrate drilling fluid transfers are performed in accordance with the applicable contractor procedures.

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Environmental Performance Outcomes, Standards and Measurement Criteria			
Outcomes	***Controls***	***Standards***	***Measurement Criteria***
	C 15.3 Check the functionality of: • SCE (augers and cuttings dryer) • mud tanks • mud tank room • transfer hoses • NWBM base fluid transfer lines • NWBM base fluid transfer station • base fluid storage	**PS 15.3** Functionality checks on mud handling equipment prevents unacceptable use or discharge of NWBM/base oil.	**MC 15.3.1** Records demonstrate the presence and functionality of the specified equipment.

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6.7.7 Unplanned Discharges: Deck and Subsea Spills

Context		
Project Fluids – **Section 3.15** Project Vessels – **Section 3.8**	Physical Environment – **Section 4.4** Biological Environment – **Section 4.5**	Stakeholder Consultation – **Section 5**

Risk Evaluation Summary

Source of Risk	***Environmental Value Potentially Impacted***							***Evaluation***						
	Soil and Groundwater	Marine Sediment	Water Quality	Air Quality (incl Odour)	Ecosystems/ Habitat	Species	Socioeconomic	Decision Type	Consequence/Impact	Likelihood	Risk Rating	ALARP Tools	Acceptability	Outcome
Accidental discharge of hydrocarbons/ chemicals from MODU and project vessels deck activities and equipment (e.g. cranes) and from subsea ROV hydraulic leaks within the Operational Area			X			X		A	F	2	L	LCS GP PJ	Broadly acceptable	EPO 16

Description of Source of Risk

Unplanned hydrocarbon and chemical spills

Deck spills can result from spills from stored hydrocarbons/chemicals or equipment. Project vessels typically store hydrocarbon/chemicals in various volumes (20 L, 205 L; up to approximately 4000–6000 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). Helicopter refuelling may also take place within the Operational Area, on the helipad of the MODU and project vessels.

Minor leaks during wire line activities (i.e. P&A activities) with a live well are described to include leaks such as:

- leaks from the lubricator, stuffing box and hose or fitting failure, which are expected to be less than 10 L (0.01 m^3)
- loss of containment – fluids – surface holding tanks
- back loading of raw slop fluids in an Intermediate Bulk Containers
- stuffing box leak / under pressure
- draining of lubricator contents
- excess grease / lubricant leaking from the grease injection head
- wind-blown lubricant dripping from cable / on deck
- lubricant used to lubricate hole.

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.

Subsea spills can result from a loss of containment of fluids from subsea equipment including the BOP or ROVs. A review of these spills to the marine environment in the past 12 months showed subsea spills did not exceed approximately 26 L in Woodside's Drilling function.

The ROV hydraulic fluid is supplied through hoses containing approximately 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.

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All chemicals that may be released or discharged to the marine environment during the Petroleum Activities Program are assessed as per Woodside Chemical Selection and Assessment. This procedure is used to demonstrate that the potential impacts of the chemicals that may be released are acceptable and ALARP.

The relatively small planned discharges associated with the Petroleum Activities Program are not expected to have impacts beyond the Operational Area.

Consequence Assessment

Accidental spills of hydrocarbons or chemicals from the MODU and project vessels will decrease the water quality in the immediate area of the spill; however, the impacts are expected to be temporary and very localised due to dispersion and dilution in the open ocean environment.

The potential biological and ecological impacts associated with hydrocarbon spills are presented in **Sections 6.7.2** to **6.7.4** and impacts from minor chemical spills are described in **Section 6.7.5**. A minor loss of hydrocarbons from deck and subsea spills will be much reduced in terms of spatial and temporal scales from impacts described in **Section 6.7.2** to **6.7.4**. Given the small area of the potential spill and the dilution and weathering of any spill, the likelihood of ecological impacts to marine fauna (including protected species), other communities and habitats will be limited to no lasting effect and restricted to individual animals, and temporary, localised contamination of water.

Summary of Potential Impacts to Environmental Value(s)

Given the adopted controls, it is considered that minor hydrocarbon/chemical spills to the marine environment will not result in a potential impact to water quality greater than localised contamination above background levels with no lasting effect, quality standards or known effect concentrations and will not result in a potential impact greater than localised disruption to a small proportion of biological populations with no impact on protected species.

Demonstration of ALARP

Control Considered	*Control Feasibility (F) and Cost/Sacrifice (CS)*[28]	*Benefit in Impact/Risk Reduction*	*Proportionality*	*Control Adopted*
Legislation, Codes and Standards				
Marine Order 91 (marine pollution prevention – oil) 2014, requires Ship Oil Pollution Emergency Plan (SOPEP)/Spill Monitoring Programme Execution Plan (SMPEP) (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 14.1**
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 16.1**
Good Practice				
Where there is potential for loss of primary containment of oil and chemicals on the MODU, deck drainage will be collected via a closed drainage system. E.g. drill floor.	F: Yes. CS: Minimal cost. Standard practice.	Reduces the likelihood of contaminated deck drainage water being discharged to the marine environment.	Benefits outweigh cost/sacrifice.	Yes **C 6.3**
Spill kits positioned in high risk locations around the MODU and Project vessels (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 16.2**

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[28] Qualitative measure

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Demonstration of ALARP				
Control Considered	***Control Feasibility (F) and Cost/Sacrifice (CS)[28]***	***Benefit in Impact/Risk Reduction***	***Proportionality***	***Control Adopted***
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 16.3**
Fluids and additives intended or likely to be discharged to the marine environment will have an environmental assessment completed before use.	F: Yes. CS: Minimal cost. Standard practice	Environmental assessment of chemicals will reduce the consequence of impacts resulting from discharges to the marine environment by ensuring chemicals have been assessed for environmental acceptability. Planned discharges are required for the safe execution of activities and therefore no reduction in likelihood can occur.	Benefits outweigh cost/sacrifice.	Yes **C 7.1**
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 transfers via hose or smaller containers. CS: Not considered – control not feasible.	Not considered – control not feasible.	Not considered – control not feasible.	No
A reduction in the volumes of chemicals and hydrocarbons stored onboard the vessel.	F: Yes. Increases the risks associated with transportation and lifting operations. CS: Project delays if required chemicals not on board. Increases the risks associated with transportation and lifting operations.	No reduction in likelihood or consequence since chemicals will still be required to enable activities to occur.	Disproportionate. The cost/sacrifice outweighs the benefit gained.	No

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Demonstration of ALARP				
Control Considered	***Control Feasibility (F) and Cost/Sacrifice (CS)[28]***	***Benefit in Impact/Risk Reduction***	***Proportionality***	***Control Adopted***

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, **Section 2.6.1**), 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 risk assessment has determined that an unplanned minor discharge of hydrocarbons as a result of minor deck and subsea spills represents a low risk that is unlikely to result in potential impact greater than localised and temporary disruption but not impacting on ecosystem function. BIAs within the Operational Area include flatback turtle internesting, whale shark foraging, and wedge-tailed shearwater breeding BIA. However, these species are not expected to be impacted.

The adopted controls are consistent with industry legislation, codes and standards, good practice and professional judgement and meet the expectations of Australian Marine Orders. On the basis of the environmental impact assessment outcomes and Woodside's criteria for acceptability outlined in **Section 2.7.2**, this is considered an acceptable level of risk.

Environmental Performance Outcomes, Standards and Measurement Criteria			
Outcomes	***Controls***	***Standards***	***Measurement Criteria***
EPO 16 No unplanned spills to the marine environment from deck activities greater than a consequence level of F[29] during the Petroleum Activities Program.	**C 14.1** See **Section 6.7.5**	**PS 14.1** See **Section 6.7.5**	**MC 13.1.1** See **Section 6.7.5**
	C 16.1 Liquid chemical and fuel storage areas are bunded or secondarily contained when they are not being handled/ moved temporarily.	**PS 16.1** Failure of primary containment in storage areas does not result in loss to the marine environment.	**MC 16.1.1** Records confirms all liquid chemicals and fuel are stored in bunded/ secondarily contained areas when not being handled/moved temporarily.
	C 6.3 See **Section 6.6.4**	**PS 6.3** See **Section 6.6.4**	**MC 6.3.1** See **Section 6.6.4**
	C 16.2 Spill kits positioned in high risk locations around the rig (near potential spill points such as transfer stations).	**PS 16.2** Spill kits to be available for use to clean up deck spills.	**MC 16.2.1** Records confirms spill kits are present, maintained and suitably stocked.
	C 16.3 Project vessels have self-containing hydraulic oil drip tray management system.	**PS 16.3** Contain any on-deck spills of hydraulic oil.	**MC 16.3.1** Records demonstrate Project vessels are equipped with a self-containing hydraulic oil drip tray management system.
	C 7.1 See **Section 6.6.5**	**PS 7.1** See **Section 6.6.5**	**MC 7.1.1** See **Section 6.6.5**

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[29] Defined as 'No lasting effect (<1 month). Localised impact not significant to environmental receptor'.

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<table>
<tr><th colspan="4">Environmental Performance Outcomes, Standards and Measurement Criteria</th></tr>
<tr><th>Outcomes</th><th>Controls</th><th>Standards</th><th>Measurement Criteria</th></tr>
<tr><td colspan="4">Detailed preparedness and response performance outcomes, standards and measurement criteria for the Petroleum Activities Program are present in Appendix D.</td></tr>
</table>

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6.7.8 Unplanned Discharges: Release of Solid Hazardous and Non-hazardous Wastes

Context		
Project Vessels– **Section 3.8**	Physical Environment – **Section 4.4** Biological Environment – **Section 4.5**	Stakeholder Consultation – **Section 5**

Risk Evaluation Summary														
Source of Risk	***Environmental Value Potentially Impacted***							***Evaluation***						
	Soil and Groundwater	Marine Sediment	Water Quality	Air Quality (incl Odour)	Ecosystems/ Habitat	Species	Socioeconomic	Decision Type	Consequence/Impact	Likelihood	Risk Rating	ALARP Tools	Acceptability	Outcome
Accidental loss of hazardous or non-hazardous wastes to the marine environment (excludes sewage, grey water, putrescible waste and bilge water)			X		X	X		A	F	2	L	LCS GP PJ	Broadly Acceptable	EPO 17

Description of Source of Risk
The MODU and 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 campaigns has primarily been windblown or dropped overboard and has included things such as personal protective equipment and small tools or materials. These events have occurred during backloading activities, periods of adverse weather and incorrect waste storage.

Consequence 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 is not likely to have a significant environmental impact, 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 Value(s)
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)***[30]	***Benefit in Impact/Risk Reduction***	***Proportionality***	***Control Adopted***
Legislation, Codes and Standards				

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[30] Qualitative measure

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Demonstration of ALARP				
Control Considered	***Control Feasibility (F) and Cost/Sacrifice (CS)***[30]	***Benefit in Impact/Risk Reduction***	***Proportionality***	***Control Adopted***
Marine Order 95 – Pollution prevention – garbage (as appropriate to vessel class), which requires putrescible waste and food scraps are passed through a macerator so that it is capable of passing through a screen with no opening wider than 25 mm.	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**
Good Practice				
Drilling and Completions waste arrangements, which require: • dedicated space for waste segregation bins and skips to be provided on the MODU • records of all waste to be disposed, treated or recycled • waste streams to be handled and managed according to their hazard and recyclability class • all non-putrescible waste (excludes all food, greywater or sewage waste) to be transported from the MODU and disposed onshore.	F: Yes. CS: Minimal cost. Standard practice.	Reduces the likelihood of an unplanned release. The consequence is unchanged.	Benefit outweighs cost/sacrifice.	Yes **C 17.1**
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 17.2**
If safe and practicable to do so, vessel, ROV, or crane will be used to attempt recovery of material[31] environmentally hazardous or non-	F: Yes. CS: Minimal cost. Standard practice.	Potentially reduces consequence by recovering object/waste container from the environment.	Benefit outweighs cost/sacrifice.	Yes **C 17.3**

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[31] For this control /performance standard, 'material' is defined as unplanned releases of environmentally hazardous or non-hazardous solid object/waste events with an environmental consequence of >F

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Demonstration of ALARP				
Control Considered	***Control Feasibility (F) and Cost/Sacrifice (CS)[30]***	***Benefit in Impact/Risk Reduction***	***Proportionality***	***Control Adopted***
hazardous solid object/waste lost overboard.				
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, **Section 2.6.1**), Woodside considers the adopted controls appropriate to manage the risks and consequences of accidental discharges of waste. As no reasonable additional/alternative controls were identified that would further reduce the risks and consequences without grossly disproportionate sacrifice, the risks and consequences are considered ALARP.				

Demonstration of Acceptability
Acceptability Statement The impact assessment has determined that unplanned discharges from a release of solid hazardous and non-hazardous wastes represent a low current risk rating and may result in localised impacts with no lasting effect (<1 month) to water quality, habitats (but not ecosystems) and species. BIAs within the Operational Area include flatback turtle internesting, whale shark foraging, and wedge-tailed shearwater breeding BIA. Relevant recovery plans and conservation advice have been considered during the impact assessment, and the Petroleum Activities Program is not considered to be inconsistent with the overall recovery objectives and actions of these recovery plans and conservation advice. The adopted controls are considered consistent with industry legislation, codes and standards, good practice and professional judgement and meet the expectations of Australian Marine Orders. On the basis of the environmental impact assessment outcomes and Woodside's criteria for acceptability outlined in **Section 2.7.2**, this is considered an acceptable level of risk.

Environmental Performance Outcomes, Standards and Measurement Criteria			
Outcomes	***Controls***	***Standards***	***Measurement Criteria***
EPO 16 No unplanned release of solid hazardous or non-hazardous waste to the marine environment greater than a consequence level of F[32] during the Petroleum Activities Program.	**C 6.1** See **Section 6.6.4**	**PS 6.1** See **Section 6.6.4**	**MC 6.1.1** See **Section 6.6.4**
	C 17.1 Drilling and Completions waste arrangements will be applied, which require: • dedicated space for waste segregation bins and skips to be provided on the MODU • records of all waste to be disposed, treated or recycled	**PS 17.1** Hazardous and non-hazardous waste will be managed in accordance with the Drilling and Completions waste arrangements.	**MC 17.1.1** Records demonstrate compliance against Drilling and Completions waste arrangements.

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[32] Defined as 'No lasting effect (less than one month). Localised impact not significant to areas or items of cultural significance)'.

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Environmental Performance Outcomes, Standards and Measurement Criteria			
Outcomes	***Controls***	***Standards***	***Measurement Criteria***
	• waste streams to be handled and managed according to their hazard and recyclability class • all non-putrescible waste (excludes all food, greywater or sewage waste) to be transported from the MODU and disposed onshore.		
	C 17.2 Project vessel waste arrangements will be applied, 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 17.2** Hazardous and non-hazardous waste managed in accordance with the project vessels' waste arrangements	**MC 17.2.1** Records demonstrate compliance against project vessels' waste arrangements.
	C 17.3 If safe and practicable to do so, vessel, ROV, or crane will be used to attempt recovery of solid object/waste lost overboard.	**PS 17.3** Material solid waste or object/waste dropped to the marine environment will be recovered where safe and practicable to do so, considering: • 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, ROV availability and suitable weather).	**MC 17.3.1** Records detail the recovery attempt consideration and status of any object/waste lost to the marine environment.

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6.7.9 Physical Presence (Unplanned): Vessel Collision with Marine Fauna

Context		
Project Vessels– **Section 3.8**	Biological Environment – **Section 4.5**	Stakeholder Consultation – **Section 5**

Risk Evaluation Summary

Source of Risk	*Environmental Value Potentially Impacted*							*Evaluation*						
	Soil and Groundwater	Marine Sediment	Water Quality	Air Quality (incl Odour)	Ecosystems/ Habitat	Species	Socioeconomic	Decision Type	Consequence/Impact	Likelihood	Risk Rating	ALARP Tools	Acceptability	Outcome
Accidental collision between project vessels/MODU and protected marine fauna within the Operational Area						X		A	E	1	L	LCS GP PJ	Broadly Acceptable	EPO 18

Description of Source of Risk

The project vessels operating in and around the Operational Area may present a potential hazard to cetaceans (e.g. humpback whales, fin whales) and other protected marine fauna, such as marine turtles and whale sharks. 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. The factors that contribute to the frequency and severity of impacts due to collisions 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. Project vessels would typically be stationary or moving at low speeds when supporting the Petroleum Activities Program; support vessels typically transit to and from the Operational Area between two and four trips per week (e.g. to port).

Consequence Assessment

Vessel collisions with marine fauna have potential to occur within the Operational Area. Vessel disturbance is a key threat to a number of migratory and threatened species identified as occurring within the Operational Area including cetaceans, marine turtles and whale sharks. Relevant conservation actions outlined in recovery plans and threat abatement plans are outlined in **Appendix H: Section 3.2**. Three species have BIAs that intercept the Operational Area:

- flatback turtle internesting buffer BIA
- flatback internesting habitat critical to the survival of marine turtle species
- whale shark foraging BIA
- and wedge-tailed shearwater breeding BIA.

Refer to **Section 4.5.2** for more information about these species and details of seasonal timings.

The likelihood of vessel/fauna 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. Project vessels within the Operational Area are likely to be travelling <8 knots (and will often be stationary), therefore, the chance of a vessel collision with protected species resulting in a lethal outcome is considered unlikely, as fauna can move away from project vessels.

Cetaceans

No known key cetacean aggregation areas (resting, breeding or feeding) are located within or immediately adjacent to the Operational Area and there is no overlap with BIAs for cetacean species. However, individuals may transit through the Operational Area and increased numbers may occur during whale migration periods (**Section 4.5.2.3**).

According to the data of Vanderlaan and Taggart (2007), it is estimated that the risk of lethal injury to a large whale as a result of a vessel strike is less than 10% at a speed of 4 knots. 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 6 knots; both of these were from whale-watching

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vessels that were deliberately positioned amongst whales. Given the duration of activities within the Operational Area and the slow speeds at which project vessels operate, collisions with cetaceans such as pygmy blue and humpback whales are considered very unlikely.

Whale sharks

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 North West Shelf waters including the Operational Area during their migrations to and from Ningaloo Reef. However, it is expected that whale shark presence within the Operational Area would not comprise high numbers and their presence would be transitory and of a short duration.

Marine turtles

Turtles are also at risk from vessel strikes, particularly in shallow coastal foraging habitats and internesting areas where there are high numbers of recreational and commercial vessels (Commonwealth of Australia, 2017). Considering the distance of the Operational Area from the nearest nesting beaches (Montebello Islands are approximately 50 km away), it is expected that the presence of marine turtles, including flatback turtles, would be very unlikely and only comprise individuals transiting the open, offshore waters for short periods of time.

It is unlikely that vessel movement associated with the Petroleum Activities Program will have a significant impact on marine fauna populations, given the low presence of transiting individuals and the low operating speed of the support vessels (generally less than eight knots or stationary, unless operating in an emergency).

Summary of Potential Impacts to Environmental Value(s)

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)***[33]	***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[34]: • Project vessels will not travel greater 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	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 collision is unchanged.	Controls based on legislative requirements – must be adopted.	Yes **C 18.1**

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[33] Qualitative measure

[34] 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.

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Demonstration of ALARP				
Control Considered	***Control Feasibility (F) and Cost/Sacrifice (CS)***[33]	***Benefit in Impact/Risk Reduction***	***Proportionality***	***Control Adopted***
at a constant speed of less than six knots. • Project vessels will not travel greater 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.				
Good Practice				
Variation of the timing of the Petroleum Activities Program to avoid migration and foraging periods.	F: No. Timing of activities is linked to MODU schedule. Timing of all activities is currently not determined and, due to MODU availability and operational requirements, performing activities during migration seasons may not be able to be avoided. CS: Not considered, control not feasible.	Not considered, control not feasible.	Not considered, control not feasible.	No
Professional Judgement – Eliminate				
No additional controls identified.				
Professional Judgement – Substitute				
No additional controls identified.				
Professional Judgement – Engineered Solution				
The use of dedicated MFOs on support vessels for the duration of each activity to watch for whales and provide direction about and monitor compliance with Part 8 of the EPBC Regulations.	F: Yes. However, vessel bridge crews already maintain a constant watch during operations in compliance with the Woodside Marine – Charterers Instructions on the requirements of vessel and whale interactions, and crew perform specific cetacean observation training. CS: Additional cost of MFOs considered unnecessary.	Given that support vessel bridge crews already maintain a constant watch during operations in compliance with the Woodside Marine – Charterers Instructions, 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, **Section 2.6.1**), Woodside considers the adopted controls appropriate to manage the risks and consequences of potential vessel collision with protected marine fauna. As no reasonable additional/alternative				

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Demonstration of ALARP				
Control Considered	***Control Feasibility (F) and Cost/Sacrifice (CS)[33]***	***Benefit in Impact/Risk Reduction***	***Proportionality***	***Control Adopted***
controls were identified that would further reduce the risks and consequences without grossly disproportionate sacrifice, the risks and consequences are considered ALARP.				

Demonstration of Acceptability
Acceptability Statement
The impact assessment has determined that, given the adopted controls, a vessel collision with marine fauna represents a low current risk rating that may result in slight, short-term impacts (<1 year) to species. Relevant BIAs within the Operational Area include flatback turtle internesting and whale shark foraging BIAs. Relevant recovery plans and conservation advice have been considered during the impact assessment, and the Petroleum Activities Program is not considered to be inconsistent with the overall recovery objectives and actions of these recovery plans and conservation advice (**Section 6.8**).
The adopted controls are considered consistent with industry good practice and professional judgement and meet the requirements of Part 8 (Division 8.1) of the EPBC Regulations 2000. On the basis of the environmental impact assessment outcomes and Woodside's criteria for acceptability outlined in **Section 2.7.2**, this is considered an acceptable level of risk.

Environmental Performance Outcomes, Standards and Measurement Criteria			
Outcomes	***Controls***	***Standards***	***Measurement Criteria***
EPO 18 No vessel strikes with protected marine fauna (whales, whale sharks, turtles) during the Petroleum Activities Program.	**C 18.1** EPBC Regulations 2000 – Part 8 Division 8.1 Interacting with cetaceans, including the following measures[35]: • Project vessels will not travel greater 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. • Project vessels will not travel greater than eight knots within 250 m of a whale	**PS 18.1.1** Compliance with EPBC Regulations 2000 – Part 8 Division 8.1 (Regulation 8.05 and 8.06) Interacting with cetaceans to minimise the potential for vessel strike and application of these regulations to whale sharks and marine turtles.	**MC 18.1.1** Records demonstrate no breaches with EPBC Regulations 2000 – Part 8 Division 8.1 Interacting with cetaceans and application of these regulations to whale sharks and marine turtles.
		PS 18.1.2 All vessel strike incidents with cetaceans, whale sharks and marine turtles reported in the National Ship Strike Database (as outlined in the Conservation Management Plan for the Blue Whale – A Recovery Plan under the EPBC Act 1999, CoA, 2015).	**MC 18.1.2** Records demonstrate reporting cetacean, whale shark and marine turtle ship strike incidents to the National Ship Strike Database.

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[35] 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.

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Environmental Performance Outcomes, Standards and Measurement Criteria			
Outcomes	***Controls***	***Standards***	***Measurement Criteria***
	shark and not allow the vessel to approach closer than 30 m of a whale shark.		

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6.7.10 Physical Presence: Disturbance to Seabed from Loss of Station Keeping

Context		
Project Vessels – **Section 3.8**	Physical Environment – **Section 4.4** Biological Environment – **Section 4.5**	Stakeholder Consultation – **Section 5**

Risk Evaluation Summary

Source of Risk	***Environmental Value Potentially Impacted***							***Evaluation***						
	Soil and Groundwater	Marine Sediment	Water Quality	Air Quality (incl Odour)	Ecosystems/ Habitat	Species	Socioeconomic	Decision Type	Consequence/Impact	Likelihood	Risk Rating	ALARP Tools	Acceptability	Outcome
Loss of station keeping of MODU leading to seabed disturbance			X		X			A	E	0	L	GP PJ RB A	Broadly acceptable	EPO 19

Description of Source of Risk
A moored MODU is planned to be used for the Petroleum Activities Program for permanently plugging the wells. The MODU will be secured on station by a number of mooring lines, as dictated by the mooring analysis, which are held in place by anchors deployed to the seabed (**Section 3.10.3**). High energy weather events such as cyclones, while the MODU is on station, can lead to excessive loads on the mooring lines resulting in failure (either anchor(s) dragging or mooring lines parting). A failure of mooring integrity may lead to the mooring lines and anchors attached to the MODU being trailed across the seabed. If mooring failure is sufficient, the MODU may move off station, increasing the likelihood of anchor drag across the seafloor. The project vessels will hold station using a DP system; therefore, anchor drag from project vessels is not credible. Industry statistics from the North Sea show that a single mooring line failure for MODU is the most common failure mechanism (33 × 10-4 per line per year), followed by a double mooring line failure (11 × 10-4 per line per year) (Petroleumstilsynet, 2014). Note that single and double mooring line failures do not typically result in the loss of station keeping. In the event of partial or complete mooring failures that are sufficient to result in a loss of station keeping, industry experience indicates that MODU may drift considerable distances from their initial position (Offshore: Risk and Technology Consulting Inc., 2002). Partial mooring failures leading to a loss of station keeping resulted in smaller MODU displacements, due to the remaining anchors dragging along the seabed when compared to complete mooring failures; complete mooring failures resulted in a freely drifting MODU (Offshore: Risk and Technology Consulting Inc., 2002). Such events are typically caused by high energy weather events such as cyclones, which can lead to excessive loads on the mooring lines, resulting in failure (either anchor(s) dragging or mooring lines parting). A failure of mooring integrity may lead to the mooring lines and anchors attached to the MODU being trailed across the seabed. However, during the Petroleum Activities Program, MODU activities are not planned to be conducted within cyclone season, therefore limiting cyclone-induced risks and reducing the likelihood of anchor drag to remote.

Consequence Assessment
MODU activities are not planned to be conducted within cyclone season. During the very unlikely event of the MODU breaking its moorings outside of the cyclone season, the anchors could drag along the seabed, potentially disturbing benthic communities in the area. Anchor drag along the seabed is unlikely to cause 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**). Given the depth of the Operational Area, it is unlikely there will be any habitats other than soft sediments that would be impacted by anchor drag. Given the overlap of the Petroleum Activities Petroleum Operational Area with the Wheatstone pipeline and the JDP2 flowline and umbilical (**Section 4.6.6**), there is potential for anchor drag to impact either the pipeline or flowline and umbilical. As outlined in **Section 6.5**, the Wheatstone Start-Up and Operations Environment Plan provides a description and assessment of impacts and risks associated with a loss of integrity of the Wheatstone pipeline, including management controls and response capabilities. The Julimar Operations Environment Plan provides a

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Consequence Assessment
description and assessment of the impacts and risks associated with a loss of integrity of the JDP2 flowline and umbilical including management controls and response capabilities. Controls to minimise the risk of loss of station keeping from the MODU are included below. Given the low sensitivity of the environment and the fact that anchor drag incidents are infrequent within the industry and typically associated with cyclone events, it is unlikely that a loss of station keeping would result in significant impact on benthic communities.
Summary of Potential Impacts to Environmental Value(s)
Given the adopted controls, seabed disturbance from a loss of station keeping will result in impacts to soft sediment benthic communities would result in only slight, short-term impacts (i.e. Environment Impact – E).

Demonstration of ALARP				
Control Considered	***Control Feasibility (F) and Cost/Sacrifice (CS)***[36]	***Benefit in Impact/Risk Reduction***	***Proportionality***	***Control Adopted***
Legislation, Codes and Standards				
No additional controls identified.				
Good Practice				
Specifications and requirements for station keeping equipment (mooring systems) require that: • systems are tested and inspected in accordance with API RP 21 • systems have sufficient capability such that a failure of any single component will not cause progressive failure of the remaining anchoring arrangement	F: Yes. CS: Minimal cost. Standard practice.	Reduces the likelihood of mooring failure leading to loss of station keeping. Should mooring failure occur, no significant reduction in consequence could occur.	Benefit outweighs cost sacrifice.	Yes **C 19.1**
Project-specific Mooring Design Analysis.	F: Yes. CS: Minimal cost. Standard practice.	Reduces the likelihood of mooring failure occurring. Although no reduction in consequence would occur, the overall risk is reduced.	Benefit outweighs cost/sacrifice.	Yes **C 3.1**
Mooring system is tested to recommended tension as per API RP 2SK.	F: Yes. CS: Minimal cost. Standard practice.	Reduces the likelihood of anchor drag leading to seabed disturbance.	Benefit outweighs cost/sacrifice.	Yes **C 19.2**
Professional Judgement – Eliminate				
Use a DP MODU (no anchoring required).	F: No. CS: No. It is not feasible to use a DP MODU as the	Not assessed, control not feasible.	Not assessed, control not feasible.	No

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[36] Qualitative measure

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Demonstration of ALARP				
Control Considered	***Control Feasibility (F) and Cost/Sacrifice (CS)[36]***	***Benefit in Impact/Risk Reduction***	***Proportionality***	***Control Adopted***
	Operational Area is too shallow. Woodside has a demonstrated capacity to manage the environmental risks and impacts from mooring to a level that is ALARP and acceptable.			
Professional Judgement – Substitute				
None identified.				
Professional Judgement – Engineered Solution				
To reduce risk of lost of containment from the JDP2 flowline and Wheatstone pipeline, permanent plugging for abandonment activities conducted by the MODU will commenc and are planned to be completed outside cyclone season (conducted between 1 May and 30 October). Permanent plugging activities will only continued beyond 30 October if a risk assessment has been undertaken and additional controls considered to determine the risk is ALARP and acceptable.	F: Yes. CS: Minimal cost. Completing MODU activities outside cyclone season will reduce the risk of mooring failure leading to loss of station keeping.	Reduces the likelihood of mooring failure leading to loss of station keeping. Should mooring failure occur, no significant reduction in consequence could occur.	Benefit outweighs cost sacrifice.	Yes **C 19.3**
MODU tracking equipment operational when the MODU is unmanned.	F: Yes. CS: Minimal cost. Standard practice.	Reduces the likelihood of a loss of station keeping occurring. Although no reduction in consequence could occur, the overall risk is reduced.	Benefit outweighs cost/sacrifice.	Yes **C 19.4**
Risk Based Analysis				
None 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, **Section 2.6.1**), Woodside considers the adopted controls appropriate to manage the risks and consequences of seabed disturbance from a loss of station keeping. As no reasonable additional/alternative controls were identified that would further reduce the risks and consequences without grossly disproportionate sacrifice, the risks and consequences are considered ALARP.				

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Demonstration of Acceptability
Acceptability Statement The impact assessment has determined that disturbance to seabed from a loss of station keeping represents a low current risk rating and may result in slight, short-term impacts (>1 year) on habitat (but not affecting ecosystems function), physical or biological attributes. The adopted controls are considered consistent with industry good practice and professional judgement. On the basis of the environmental impact assessment outcomes and Woodside's criteria for acceptability outlined in **Section 2.7.2**, this is considered an acceptable level of risk.

Environmental Performance Outcomes, Standards and Measurement Criteria			
Outcomes	***Controls***	***Standards***	***Measurement Criteria***
EPO 19 No mooring failure for the MODU during the Petroleum Activities Program resulting in seabed disturbance greater than a consequence level E[37]**.**	**C 19.1** Specifications and requirements for station keeping equipment (mooring systems), require that: • systems are tested and inspected in accordance with API RP 21 • systems have sufficient capability such that a failure of any single component will not cause progressive failure of the remaining anchoring arrangement.	**PS 19.1** MODU mooring system tested and in place to ensure no complete mooring failure.	**MC 19.1.1** Records demonstrate mooring system tests and inspection.
	C 3.1 See **Section 0**	**PS 3.1** See **Section 0**	**MC 3.1.1** See **Section 0**
	C 19.2 Mooring system is tested to recommended tension as per API RP 2SK.	**PS 19.2** Monitoring compliant with ISO 19901-7:2013.	**MC 19.2.1** Records confirm mooring system is tested to recommended.
	C 19.3 To reduce risk of lost of containment from the JDP2 flowline and Wheatstone pipeline, permanent plugging for abandonment activities conducted by the MODU will commence and are planned to be completed outside cyclone season (conducted between 1 May and 30 October). Permanent plugging activities will only continued beyond 30	**PS 19.3** Permanent plugging for abandonment activities by the MODU commence outside the cyclone season (between 1 May and 30 October). Any permanent plugging for abandonment activities forecast to continue past 30 October will undergo a risk assessment to determine whether the activity can proceed into cyclone season, including whether additional controls	**MC 19.3.1** Records demonstrate MODU activities commenced outside of cyclone season.
			MC 19.3.2 Completed risk assessment for permanent plugging for abandonment activities that extend beyond the 30 October demonstrates the risk is ALARP and acceptable.
			MC 19.3.3

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[37] Defined as 'Slight, short term local impact (less than one year), on species, habitat (but not affecting ecosystem function), physical or biological attributes'.

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Environmental Performance Outcomes, Standards and Measurement Criteria			
Outcomes	***Controls***	***Standards***	***Measurement Criteria***
	October if a risk assessment has been undertaken and additional controls considered to determine the risk is ALARP and acceptable.	are required.	Evidence of additional controls, where required, have been implemented from the risk assessment.
	C 19.4 MODU tracking equipment operational when the MODU is unmanned.	**PS 19.4** Tracking of the MODU is possible when the MODU is unmanned.	**MC 19.4.1** Records show the MODU has functional tracking equipment for instances when MODU is unmanned.

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6.7.11 Physical Presence: Dropped Object Resulting in Seabed Disturbance

Context		
Project Vessels– **Section 3.8** Permanent Plugging Activities – **Section 3.10**	Physical Environment – **Section 4.4** Biological Environment – **Section 4.5**	Stakeholder Consultation – **Section 5**

Risk Evaluation Summary														
	Environmental Value Potentially Impacted							***Evaluation***						
Source of Risk	Soil and Groundwater	Marine Sediment	Water Quality	Air Quality (incl Odour)	Ecosystems/ Habitat	Species	Socioeconomic	Decision Type	Consequence/Impact	Likelihood	Risk Rating	ALARP Tools	Acceptability	Outcome
Dropped objects resulting in the disturbance of benthic habitat		X			X			A	F	2	L	LCS GP PJ	Broadly Acceptable	EPO 20

Description of Source of Risk
There is the potential for objects to be dropped overboard from the MODU and project vessels to the marine environment. Objects that have been dropped during previous offshore activities include small numbers of personal protective gear (e.g. glasses, gloves, hard hats), small tools (e.g. spanners) hardware fixtures (e.g. riser hose clamp) and drill equipment (e.g. drill pipe); however, there is also potential for larger equipment to also be dropped during the activity, particularly during recovery of infrastructure from the seabed. The spatial extent in which dropped objects can occur is restricted to Operational Area.

Consequence Assessment
Potential Impacts to Benthic Communities
In the unlikely event of loss of an object being dropped into the marine environment, potential environmental effects would be limited to localised physical impacts on benthic communities. In most cases, objects will be able to be recovered and therefore these impacts will also be temporary in nature. However, there may be instances where objects are unable to be recovered due to health and safety, operational constraints or other factors such as the difficulty of recovering dropped objects at depth. When dropped objects are unable to be recovered, the impact will continue to be localised but would also be long-term. The temporary or permanent loss of dropped objects into the marine environment is likely to result in a localised impact only, as the benthic communities associated with the Operational Area are of low sensitivity and are broadly represented throughout the NWMR. As described in **Section 4.5.3**, the Ancient Coastline at 125 m Depth Contour KEF is located within the Operational Area. The habitat types associated with the hard substrate that characterises the Ancient Coastline at 125 m Depth Contour KEF are not considered to be unique by Falkner et al. (2009) in their review of KEFs in the NWMR. Furthermore, benthic habitats in the Operational Area are expected to consist of bare unconsolidated sediments dominated by silt and clay fractions (**Section 4.5.3**). Given the nature and scale of risks and consequences from dropped objects, no lasting effect is expected to seabed sensitivities associated with the Operational Area. 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 Value(s)
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).

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Demonstration of ALARP				
Control Considered	***Control Feasibility (F) and Cost/Sacrifice (CS)***[38]	***Benefit in Impact/Risk Reduction***	***Proportionality***	***Control Adopted***
Legislation, Codes and Standards				
No additional controls identified.				
Good Practice				
The MODU and project vessels' work procedures for lifts, bulk transfers and cargo loading, which require: • The security of loads shall be checked before commencing lifts. • Loads shall be covered if there is a risk of loss of loose materials. • Lifting operations shall be conducted using the PTW and JSA systems to manage the specific risks of that lift, including consideration of weather and sea state.	F: Yes. CS: Minimal cost. Standard practice.	By implementing MODU and project vessels' work procedures for lifts, bulk transfers and cargo loading, the likelihood of a dropped object event is reduced. Since the object may be recovered, a reduction in consequence is possible.	Benefits outweigh cost/sacrifice.	Yes **C 20.1**
MODU and 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. Since the object may be recovered, a reduction in consequence is possible.	Benefits outweigh cost/sacrifice.	Yes **C 20.2**
If safe and practicable to do so, vessel, ROV, or crane will be used to attempt recovery of material environmentally hazardous or non-hazardous solid object/waste lost overboard.	F: Yes. CS: Minimal cost. Standard practice.	Potentially reduces consequence by recovering object/waste container from the environment.	Benefit outweighs cost/sacrifice.	Yes **C 17.3**
Professional Judgement – Eliminate				
No additional controls identified.				
Professional Judgement – Substitute				
No additional controls identified.				
Professional Judgement – Engineered Solution				

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[38] Qualitative measure

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Demonstration of ALARP				
Control Considered	***Control Feasibility (F) and Cost/Sacrifice (CS)[38]***	***Benefit in Impact/Risk Reduction***	***Proportionality***	***Control Adopted***
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, **Section 2.6.1**), Woodside considers the adopted controls appropriate to manage the risks and consequences of seabed disturbance from dropped objects. As no reasonable additional/alternative controls were identified that would further reduce the risks and consequences without disproportionate sacrifice, the risks and consequences are considered ALARP.				

Demonstration of Acceptability
Acceptability Statement The impact assessment has determined that a dropped object resulting in seabed disturbance represents a low current risk rating and may result in localised impacts with no lasting effect (<1 month) to environmental receptors. The adopted controls are considered consistent with industry good practice and professional judgement. On the basis of the environmental impact assessment outcomes and Woodside's criteria for acceptability outlined in **Section 2.7.2**, this is considered an acceptable level of risk.

Environmental Performance Outcomes, Standards and Measurement Criteria			
Outcomes	***Controls***	***Standards***	***Measurement Criteria***
EPO 20 No incidents of dropped objects to the marine environment greater than a consequence level of F[39] during the Petroleum Activities Program.	**C 20.1** The MODU and project vessels' work procedures for lifts, bulk transfers and cargo loading, which require: • the security of loads to be checked before 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 20.1** All lifts conducted in accordance with applicable MODU/ project vessels' work procedures to limit potential for dropped objects.	**MC 20.1.1** Records show lifts conducted in accordance with the applicable MODU/ project vessels' work procedures.
	C 20.2 MODU and project vessel inductions include control measures and training for crew in dropped object prevention.	**PS 20.2** MODU and project vessels crews aware of requirements for dropped object prevention.	**MC 20.2.1** Records show dropped object prevention training is provided to the MODU/ project vessels.
	C 17.3 See **Section 6.7.8**	**PS 17.3** See **Section 6.7.8**	**MC 17.3.1** See **Section 6.7.8**

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[39] Defined as 'No lasting effect (less than one month). Localised impact not significant to areas or items of cultural significance)'.

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

Context		
Project Vessels– **Section 3.8**	Physical Environment – **Section 4.4** Biological Environment – **Section 4.5**	Stakeholder Consultation – **Section 5**

Risk Evaluation Summary

Source of Risk	***Environmental Value Potentially Impacted***							***Evaluation***						
	Soil and Groundwater	Marine Sediment	Water Quality	Air Quality (incl Odour)	Ecosystems/ Habitat	Species	Socioeconomic	Decision Type	Consequence/Impact	Likelihood	Risk Rating	ALARP Tools	Acceptability	Outcome
Introduction of invasive marine species within the Operational Area.					X	X	X	A	E	0	L	LCS	Broadly Acceptable	EPO 21

Description of Source of Risk

During the Petroleum Activities Program, vessels will be transiting to and from the Operational Area, potentially including traffic mobilising from beyond Australian waters. These project vessels may include the MODU, IMR vessel or AHV and general support vessels (**Section 3.8.1**).

All vessels are subject to some level of marine fouling whereby organisms attach to the vessel hull. This could particularly occur 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.). Organisms can also be drawn into ballast tanks during onboarding of ballast water as cargo is loaded or to balance vessels under load.

During the Petroleum Activities Program, project vessels have the potential to introduce IMS to the Operational Area through marine fouling (containing IMS) on vessels as well as within high-risk ballast water discharge. Cross contamination between vessels can also occur (e.g. IMS translocated between project vessels) during times when vessels need to be alongside each other.

Consequence Assessment

Potential Impacts to Ecosystems/Habitats, Species and Socio-economic Values

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. NIMS are only considered IMS when they result in impacts to environmental values and/or have social/cultural, economic and/or human health impacts.

Once introduced, IMS may prey on local species (which had previously not been subject to this kind of predation and therefore not have evolved protective measures against the attack), 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.

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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.

Potential IMS have historically been introduced and translocated around Australia by a variety of natural and human means, including marine fouling 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).

While project vessels have the potential to introduce IMS into the Operational Area, the deep offshore open waters of the Operational Area (which are more than 100 m deep) are not conducive to the settlement and establishment of IMS. Furthermore, the Operational Area are away from shorelines and/or critical habitat. The likelihood of IMS being introduced and establishing viable populations within the Operational Area or immediate surrounds is considered not credible.

Summary of Potential Impacts to Environmental Value(s)

In support of Woodside's assessment of the risks and consequences of IMS introduction associated with the Petroleum Activities Program, Woodside conducted a risk and impact evaluation of the different aspects of an IMS translocation. The results of this assessment are presented in **Table 6-16**.

As a result of this assessment, Woodside has assessed the potential consequence and likelihood after implementing the identified controls. This assessment concluded that the highest potential consequence is a 'D' and the likelihood is 'Remote' (0), resulting in an overall 'Low' risk.

Table 6-16: Evaluation of risks and impacts from IMS 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 Operational Area are deep offshore open waters away from shorelines and/or critical habitat; therefore, they are 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/MODU within the Operational Area.	***Environment – Not credible*** The translocation of IMS from a colonised MODU or project vessel to another vessel and then to the environment is not credible. This is because the Operational Area are in deep open waters away from shorelines and/or critical habitat. Furthermore, the translocation to shallower environments via natural dispersion from a project vessel is not considered credible, given the distances of the Operational Area from nearshore environments (i.e. greater than 12 nm/50 m water depth). On this basis there is no credible environmental risk. *Reputation – D* If IMS were to establish on a project vessel, including the MODU, from another colonised vessel, this could potentially impact the vessel operationally through the fouling of intakes, and potentially cause the infected vessels to be quarantined and requiring costly cleaning. Such introduction would be expected to have minor impact to Woodside's	***Remote (0)*** Interactions between project vessels will be limited during the Petroleum Activities Program, with minimum 500 m safety exclusion zones being adhered to around the MODU, and interactions limited to short periods of time alongside (i.e. during backloading, bunkering activities). There is also no direct contact (i.e. they are not tied up alongside) during these activities. Spread of marine pests via ballast water or spawning in these open ocean

		reputation, particularly with Woodside's contractors, and may impact future proposals. This would likely have a reputational impact on future proposals.	environments is also considered remote.
Transferred between project vessels and from project vessels to other marine environments beyond the Operational Area.	***Not Credible*** This risk is considered so remote that it is not credible for the purposes of the activity. As described above, the transfer of IMS between project vessels was already considered remote, given the offshore open ocean environment. Project vessels will be located in an offshore, open ocean, deep environment, where IMS survival is implausible. Furthermore, this marine pest once transferred would need to survive on a new vessel that has good hygiene (i.e. has been through Woodside's risk assessment process), and survive the transport back from the Operational Area to shore. If it survived this trip, it would then need conditions conducive to establishing a viable population in the nearshore waters to which the infected vessel travels.		

Demonstration of ALARP				
Control Considered	***Control Feasibility (F) and Cost/Sacrifice (CS)***[40]	***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 outlined in the Australian Ballast Water Management Requirements.	F: Yes. CS: Minimal cost. Standard practice.	Reduces the likelihood of transferring marine pests between the MODU and 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 21.1**
Good Practice				
Woodside's IMS risk assessment process[41] will be applied to the MODU, project vessels and relevant immersible equipment undertaking the Petroleum Activities Program. Assessment will consider these risk factors: For vessels/ MODU: • vessel/MODU/ type • recent IMS inspection and cleaning history, including for internal niches • out-of-water period before mobilisation	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 21.2**

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[40] Qualitative measure

[41] Woodside's IMS risk assessment process was developed with regard to the national biofouling management guidelines for the petroleum production and exploration industry and guidelines for the control and management of a ships' biofouling to minimise the transfer of invasive aquatic species (IMO Guidelines, 2011).

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- age and suitability of antifouling coating at mobilisation date - internal treatment systems and history - origin and proposed area of operation - number of stationary/slow speed periods >7 days - region of stationary or slow periods - type of activity – contact with seafloor. For immersible equipment: - region of deployment since last thorough clean, particularly coastal locations - duration of deployments - duration of time out of water since last deployment - transport conditions during mobilisation - post-retrieval maintenance regime. Based on the outcomes of each IMS risk assessment, management measures commensurate with the risk (such as treating internal systems, IMS inspections or cleaning) will be implemented to minimise the likelihood of IMS being introduced.				
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 including the MODU and support vessels.	F: No. Given that vessels must be used to complete the Petroleum Activities Program, there is no	Not assessed, control not feasible.	Not assessed, control not feasible.	No

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	feasible means to eliminate the source of risk. CS: Loss of the project.			
Professional Judgement – Substitute				
Source project vessels based in Australia only.	F: Potentially. While the project will attempt to source support vessels locally, availability is not guaranteed. There are limited project vessels based in Australian waters and sourcing Australian-based vessels only will cause increases in cost due to pressures of vessel availability. CS: Significant cost and schedule impacts due to supply restrictions.	Sourcing vessels from within Australia will reduce the likelihood of IMS from outside Australian waters; however, it does not reduce the likelihood of introducing species native to Australia but alien to the Operational Area. It also does not prevent the translocation of IMS that have established elsewhere in Australia. Therefore, the consequence is unchanged.	Disproportionate. Sourcing vessels from Australian waters may result in a slight reduction in the likelihood of introducing IMS to the Operational Area but it does not completely eliminate the risk. Furthermore, the potential cost of implementing this control could be high, given the potential supply issues associated with only locally sourcing vessels.	No
IMS inspection of all vessels.	F: Yes. CS: Significant cost and schedule impacts. In addition, Woodside's IMS risk assessment process is seen to be more cost-effective as this control allows Woodside to manage the introduction of IMS 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/sacrifice outweighs the benefit gained, as other controls that are proposed to be implemented 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 (i.e. Decision Type A, **Section 2.6.1**), Woodside considers that the adopted controls are appropriate to manage the risks and consequences of IMS introduction. As no reasonable additional/alternative controls were identified that would further reduce the risks and consequences without disproportionate cost, the risks and consequences are considered ALARP.

Demonstration of Acceptability

Acceptability Statement

The impact assessment has determined that the accidental introduction and establishment of IMS represents a low current risk rating and may result in slight, short-term impacts (>1 year) on habitat (but not affecting ecosystems function) or biological attributes. BIAs within the Operational Area include flatback turtle internesting, flatback internesting habitat

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critical to the survival of marine turtle species. whale shark foraging, and wedge-tailed shearwater breeding BIA. However, these species are not expected to be impacted.

The adopted controls are considered consistent with industry legislation, codes and standards. On the basis of the environmental impact assessment outcomes and Woodside's criteria for acceptability outlined in **Section 2.7.2**, this is considered an acceptable level of risk.

Environmental Performance Outcomes, Standards and Measurement Criteria			
Outcomes	***Controls***	***Standards***	***Measurement Criteria***
EPO 21 No introduction and establishment of IMS into the Operational Area as a result of the Petroleum Activities Program.	**C 21.1** 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 21.1** Project vessels manage ballast water in accordance with Australian Ballast Water Management Requirements.	**MC 21.1.1** Ballast Water Records System maintained by vessels which verifies compliance against Australian Ballast Water Management Requirements.
	C 21.2 Woodside's IMS risk assessment process[42] will be applied to project vessels and relevant immersible equipment undertaking the Petroleum Activities Program. Assessment will consider these risk factors: For vessels/MODU: • vessel/MODU type • recent IMS inspection and cleaning history, including for internal niches • out-of-water period before mobilisation • age and suitability of antifouling coating at mobilisation date • internal treatment systems and history • origin and proposed area of operation • number of stationary/slow speed periods >7 days • region of stationary or slow periods • type of activity – contact with seafloor. For immersible equipment:	**PS 21.2.1** Before entering the Operational Area, project vessels, MODU and relevant immersible equipment are determined to be low risk[43] of introducing IMS of concern, and maintain this low risk status to mobilisation.	**MC 21.2.1** Records of IMS risk assessments maintained for all project vessels and relevant immersible equipment entering the operational area or IMS management area to undertake the Petroleum Activities Program.
		PS 21.2.2 In accordance with Woodside's IMS risk assessment process, the IMS risk assessments will be undertaken by an authorised environment adviser who has completed relevant Woodside IMS training or by qualified and experienced IMS inspector.	**MC 21.2.2** Records confirm that the IMS risk assessments undertaken by an Environment Adviser or IMS inspector (as relevant).

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[42] Woodside's IMS risk assessment process was developed with regard to the national biofouling management guidelines for the petroleum production and exploration industry and guidelines for the control and management of a ships' biofouling to minimise the transfer of invasive aquatic species (IMO Guidelines, 2011).

[43] Low risk of introducing IMS of concern is defined as either no additional management measures required or, management measures have been applied to reduce the risk.

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Environmental Performance Outcomes, Standards and Measurement Criteria			
Outcomes	***Controls***	***Standards***	***Measurement Criteria***
	• region of deployment since last thorough clean, particularly coastal locations • duration of deployments • duration of time out of water since last deployment • transport conditions during mobilisation • post-retrieval maintenance regime. Based on the outcomes of each IMS risk assessment, management measures commensurate with the risk (such as treating internal systems, IMS inspections or cleaning) will be implemented to minimise the likelihood of IMS being introduced.		

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6.8 Recovery Plan and Threat Abatement Plan Assessment

As described in **Section 1.10**, NOPSEMA will not accept an EP that is inconsistent with a recovery plan or threat abatement plan for a listed threatened species or ecological community. This section describes the assessment that Woodside has undertaken to demonstrate that the Petroleum Activities Program is not inconsistent with any relevant recovery plans or threat abatement plans. For the purposes of this assessment, the relevant Part 13 statutory instruments (recovery plans and threat abatement plans) are:

- Recovery Plan for Marine Turtles in Australia 2017–2027 (Commonwealth of Australia, 2017).
- Conservation Management Plan for the Blue Whale 2015–2025 (Commonwealth of Australia, 2015a).
- Recovery Plan for the Grey Nurse Shark (*Carcharias taurus*) 2014 (Commonwealth of Australia, 2014).
- Sawfishes and River Sharks Multispecies Recovery Plan (Commonwealth of Australia, 2015b).
- Threat Abatement Plan for the impacts of marine debris on the vertebrate wildlife of Australia's coasts and oceans 2018 (Commonwealth of Australia, 2018).

Table 6-17 lists the objectives and (where relevant) the action areas of these plans, and also describes whether these objectives/action areas are applicable to government, the Titleholder, and/or the Petroleum Activities Program. For those objectives/action areas applicable to the Petroleum Activities Program, the relevant actions of each plan have been identified, and an evaluation has been conducted as to whether impacts and risks resulting from the activity are not inconsistent with that action. The results of this assessment against relevant actions are presented in **Table 6-18** to **Table 6-22**.

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Table 6-17: Identification of applicability of recovery plan and threat abatement plan objectives and action areas

EPBC Act Part 13 Statutory Instrument	Applicable to:		
	Government	***Titleholder***	***Petroleum Activities Program***
Marine Turtle Recovery Plan			
Long-term Recovery Objective: Minimise anthropogenic threats to allow for the conservation status of marine turtles to improve so they can be removed from the EPBC Act threatened species list	Y	Y	Y
Interim Recovery Objectives			
Current levels of legal and management protection for marine turtle species are maintained or improved, both domestically and throughout the migratory range of Australia's marine turtles	Y		
The management of marine turtles is supported	Y		
Anthropogenic threats are demonstrably minimised	Y	Y	Y
Trends in nesting numbers at index beaches and population demographics at important foraging grounds are described	Y	Y	
Action Areas			
A. Assessing and addressing threats			
A1. Maintain and improve efficacy of legal and management protection	Y		
A2. Adaptively manage turtle stocks to reduce risk and build resilience to climate change and variability	Y		
A3. Reduce the impacts of marine debris	Y	Y	Y
A4. Minimise chemical and terrestrial discharge	Y	Y	Y
A5. Address international take within and outside Australia's jurisdiction	Y		
A6. Reduce impacts from terrestrial predation	Y		
A7. Reduce international and domestic fisheries bycatch	Y		
A8. Minimise light pollution	Y	Y	Y
A9. Address the impacts of coastal development/infrastructure and dredging and trawling	Y	Y	
A10. Maintain and improve sustainable Indigenous management of marine turtles	Y		
B. Enabling and measuring recovery			

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EPBC Act Part 13 Statutory Instrument	Applicable to:		
	Government	***Titleholder***	***Petroleum Activities Program***
B1. Determine trends in index beaches	Y	Y	Y
B2. Understand population demographics at key foraging grounds	Y		
B3. Address information gaps to better facilitate the recovery of marine turtle stocks	Y	Y	Y
Blue Whale Conservation Management Plan			
Long-term recovery objective: Minimise anthropogenic threats to allow for their conservation status to improve so that they can be removed from the EPBC Act threatened species list	Y	Y	Y
Interim Recovery Objectives			
1. The conservation status of blue whale populations is assessed using efficient and robust methodology	Y		
2. The spatial and temporal distribution, identification of biologically important areas, and population structure of blue whales in Australian waters is described	Y	Y	Y
3. Current levels of legal and management protection for blue whales are maintained or improved and an appropriate adaptive management regime is in place	Y		
4. Anthropogenic threats are demonstrably minimised	Y	Y	Y
Action Areas			
A. Assessing and addressing threats			
A.1: Maintain and improve existing legal and management protection	Y		
A.2: Assessing and addressing anthropogenic noise	Y	Y	Y
A.3: Understanding impacts of climate variability and change	Y		
A.4: Minimising vessel collisions	Y	Y	Y
B. Enabling and Measuring Recovery			
B.1: Measuring and monitoring population recovery	Y		
B.2: Investigating population structure	Y		
B.3: Describing spatial and temporal distribution and defining biologically important habitat	Y	Y	Y

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EPBC Act Part 13 Statutory Instrument	**Applicable to:**		
	Government	***Titleholder***	***Petroleum Activities Program***
Grey Nurse Shark Recovery Plan			
Overarching Objective			
To assist the recovery of the grey nurse shark in the wild, throughout its range in Australian waters, with a view to: • improving the population status, leading to future removal of the grey nurse shark from the threatened species list of the EPBC Act • ensuring that anthropogenic activities do not hinder the recovery of the grey nurse shark in the near future, or impact on the conservation status of the species in the future	Y	Y	Y
Specific Objectives			
1. Develop and apply quantitative monitoring of the population status (distribution and abundance) and potential recovery of the grey nurse shark in Australian waters	Y		
2. Quantify and reduce the impact of commercial fishing on the grey nurse shark through incidental (accidental and/or illegal) take, throughout its range	Y		
3. Quantify and reduce the impact of recreational fishing on the grey nurse shark through incidental (accidental and/or illegal) take, throughout its range	Y		
4. Where practicable, minimise the impact of shark control activities on the grey nurse shark	Y		
5. Investigate and manage the impact of ecotourism on the grey nurse shark	Y		
6. Manage the impact of aquarium collection on the grey nurse shark	Y		
7. Improve understanding of the threat of pollution and disease to the grey nurse shark	Y	Y	Y
8. Continue to identify and protect habitat critical to the survival of the grey nurse shark and reduce the impact of threatening processes within these areas	Y	Y	
9. Continue to develop and implement research programs to support the conservation of the grey nurse shark	Y	Y	
10. Promote community education and awareness in relation to grey nurse shark conservation and management	Y		
Sawfish and River Sharks Recovery Plan			
Primary Objective			
To assist the recovery of sawfish and river sharks in Australian waters with a view to:	Y	Y	Y

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EPBC Act Part 13 Statutory Instrument	**Applicable to:**		
	Government	***Titleholder***	***Petroleum Activities Program***
• improving the population status leading to the removal of the sawfish and river shark species from the threatened species list of the EPBC Act • ensuring that anthropogenic activities do not hinder recovery in the near future, or impact on the conservation status of the species in the future			
Specific Objectives			
1. Reduce and, where possible, eliminate adverse impacts of commercial fishing on sawfish and river shark species	Y		
2. Reduce and, where possible, eliminate adverse impacts of recreational fishing on sawfish and river shark species	Y		
3. Reduce and, where possible, eliminate adverse impacts of Indigenous fishing on sawfish and river shark species	Y		
4. Reduce and, where possible, eliminate the impact of illegal, unregulated and unreported fishing on sawfish and river shark species	Y		
5. Reduce and, where possible, eliminate adverse impacts of habitat degradation and modification on sawfish and river shark species	Y	Y	Y
6. Reduce and, where possible, eliminate any adverse impacts of marine debris on sawfish and river shark species noting the linkages with the Threat Abatement Plan for the Impact of Marine Debris on Vertebrate Marine Life	Y	Y	Y
7. Reduce and, where possible, eliminate any adverse impacts of collection for public aquaria on sawfish and river shark species	Y		
8. Improve the information base to allow the development of a quantitative framework to assess the recovery of, and inform management options for, sawfish and river shark species	Y		
9. Develop research programs to assist conservation of sawfish and river shark species	Y	Y	
10. Improve community understanding and awareness in relation to sawfish and river shark conservation and management	Y		
Marine Debris Threat Abatement Plan			
Objectives			
1. Contribute to long-term prevention of the incidence of marine debris	Y	Y	
2. Understand the scale of impacts from marine plastic and microplastic on key species, ecological communities and locations	Y	Y	Y

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EPBC Act Part 13 Statutory Instrument	**Applicable to:**		
	Government	***Titleholder***	***Petroleum Activities Program***
3. Remove existing marine debris	Y		
4. Monitor the quantities, origins, types and hazardous chemical contaminants of marine debris, and assess the effectiveness of management arrangements for reducing marine debris	Y		
5. Increase public understanding of the causes and impacts of harmful marine debris, including microplastic and hazardous chemical contaminants, to bring about behaviour change	Y		

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Table 6-18: Assessment against relevant actions of the Marine Turtle Recovery Plan

Part 13 Statutory Instrument	Relevant Action Areas/Objectives	Relevant Actions	Evaluation	EPO, Controls and PS
Marine Turtle Recovery Plan	**Action Area A3**: Reduce the impacts from marine debris	**Action:** Support the implementation of the Marine Debris Threat Abatement Plan (TAP) Priority actions at stock level: G-NWS – Understand the threat posed to this stock by marine debris LH-WA – Determine the extent to which marine debris is impacting loggerhead turtles F-Pil & H-WA – no relevant actions	Refer **Section 6.7.8** **Not inconsistent assessment:** The assessment of the accidental release of solid hazardous and non-hazardous wastes has considered the potential risks to marine turtles. Controls have been implemented to reduce the likelihood of accidental release of solid wastes for the duration of the petroleum activities program.	N/A
	Action Area A4: Minimise chemical and terrestrial discharge	**Action:** Ensure spill risk strategies and response programs adequately include management for marine turtles and their habitats, particularly in reference to 'slow to recover habitats', e.g. nesting habitat, seagrass meadows or coral reefs Priority actions at stock level: G-NWS – Ensure that spill risk strategies and response programs include management for turtles and their habitats LH-WA & F-Pil – Ensure that spill risk strategies and response programs include management for turtles and their habitats, particularly in reference to slow to recover habitats, e.g. seagrass meadows or corals H-WA – no relevant actions	Refer **Sections 6.6.4, 6.6.5, 6.6.6, 6.7.2, 6.7.3, 6.7.4, 6.7.5, 6.7.6, 6.7.7, 6.7.8** **Not inconsistent assessment:** The assessment of accidental release of chemicals / hydrocarbons has considered the potential risks to marine turtles. Spill risk strategies and response program include management measures for turtles and their nesting habitats.	Refer **Section 7.9** Detailed oil spill preparedness and response performance outcomes, standards and measurement criteria for the Petroleum Activities Program are present in **Appendix D**
	Action Area A8: Minimise light pollution	**Action**: Artificial light within or adjacent to habitat critical to the survival of marine turtles will be managed such that marine turtles are not displaced from these habitats Priority actions at stock level: G-NWS – as above LH-WA – no relevant actions	Refer **Section 6.6.8** **Not inconsistent assessment:** The assessment of light emissions has considered the potential impacts to green, flatback and hawksbill turtles. Internesting, mating, foraging or migrating turtles are not impacted by light from offshore vessels. Vessel light emissions could cause localised and temporary behavioural disturbance to	N/A

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Part 13 Statutory Instrument	Relevant Action Areas/Objectives	Relevant Actions	Evaluation	EPO, Controls and PS
		F-Pil & H-WA – Manage artificial light from onshore and offshore sources to ensure biologically important behaviours of nesting adults and emerging/dispersing hatchlings can continue	isolated transient individuals, which is unlikely to result in displacement of adult turtles from internesting or nesting habitat critical to the survival of marine turtles.	
	Action Area B1: Determine trends at index beaches	**Action:** Maintain or establish long-term monitoring programs at index beaches to collect standardised data critical for determining stock trends, including data on hatchling production Priority actions at stock level: G-NWS – Continue long-term monitoring of index beaches LH-WA – Continue long-term monitoring of nesting and foraging populations F-Pil & H-WA – no relevant actions	**Not inconsistent assessment:** Woodside contributes to Action Area B1 via its support of the Ningaloo Turtle Program[44].	N/A
	Action Area B3: Address information gaps to better facilitate the recovery of marine turtle stocks	**Action:** Understand the impacts of anthropogenic noise on marine turtle behaviour and biology Priority actions at stock level: G-NWS – Given this is a relatively accessible stock that is likely to be exposed to anthropogenic noise – Investigate the impacts of anthropogenic noise on turtle behaviour and biology and extrapolate findings from the North West Shelf stock to other stocks LH-WA – no relevant actions F-Pil – no relevant actions H-WA – investigate mixed stock genetics at foraging grounds	Refer **Sections 6.6.3** Not inconsistent assessment: The assessment of acoustic emissions has considered the potential impacts to marine turtles. MODU and project vessel acoustic emissions could cause localised and short-term behavioural disturbance to isolated transient individuals, which is unlikely to result in displacement of adult turtles from internesting or nesting habitat critical to the survival of marine turtles.	N/A

Assessment Summary

The Marine Turtle Recovery Plan has been considered during the assessment of impacts and risks, and the Petroleum Activities Program is not considered to be inconsistent with the relevant actions of this plan.

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[44] http://www.ningalooturtles.org.au/media_reports.html

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Table 6-19: Assessment against relevant actions of the Blue Whale Conservation Management Plan

Part 13 Statutory Instrument	Relevant Action Areas/Objectives	Relevant Actions	Evaluation	EPO, Controls and PS
Blue Whale Conservation Management Plan	**Action Area A.2**: Assessing and addressing anthropogenic noise	**Action 2**: Assessing the effect of anthropogenic noise on blue whale behaviour **Action 3**: Anthropogenic noise in biologically important areas will be managed such that any blue whale continues to use the area without injury, and is not displaced from a foraging area	Refer **Sections 6.6.3** **Not inconsistent assessment**: The assessment of acoustic emissions has considered the potential impacts to pygmy blue whales. Acoustic emissions from project vessels and MODU will not cause injury to any pygmy blue whale. There are no known or possible foraging areas for pygmy blue whales within or adjacent to the Operational Area. If the Petroleum Activities Program within the Operational Area overlaps with an individual northbound or southbound migration, they may deviate slightly from the migratory route, but will continue on their migration.	N/A

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Part 13 Statutory Instrument	Relevant Action Areas/Objectives	Relevant Actions	Evaluation	EPO, Controls and PS
	Action Area A.4: Minimising vessel collisions	**Action 3**: Ensure the risk of vessel strikes on blue whales is considered when assessing actions that increase vessel traffic in areas where blue whales occur and, if required, appropriate mitigation measures are implemented	Refer **Section 6.7.9** **Not inconsistent assessment**: The assessment of vessel collision with marine fauna has considered the potential risks to pygmy blue whales. If the Petroleum Activities Program within the Operational Area overlaps with an individual northbound or southbound migration, they may deviate slightly from the migratory route, but will continue on their migration. Vessel collisions with pygmy blue whales are highly unlikely to occur, given the very slow vessel speeds.	**EPO 19** **C 19.1** **PS 19.1.1 & 19.1.2**
	Action Area B.3: Describing spatial and temporal distribution and defining biologically important habitat	**Action 2**: Identify migratory pathways between breeding and feeding grounds **Action 3**: Assess timing and residency within Biologically Important Areas	**Not inconsistent assessment**: Woodside contributes to Action Area B3 via its support of targeted research initiatives (e.g. satellite tracking of pygmy blue whale migratory movements[45]).	N/A
Assessment Summary The Blue Whale Conservation Management Plan has been considered during the assessment of impacts and risks, and the Petroleum Activities Program is not considered to be inconsistent with the relevant actions of this plan.				

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[45] Double, M.C., Andrews-Goff, V., Jenner, K.C.S., Jenner, M.-N., Laverick, S.M., Branch, T.A., Gales, N.J., 2014. Migratory movements of pygmy blue whales (*Balaenoptera musculus brevicauda*) between Australia and Indonesia as revealed by satellite telemetry. PloS One 9, e93578

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Table 6-20: Assessment against relevant actions of the Grey Nurse Shark Recovery Plan

Part 13 Statutory Instrument	Relevant Action Areas/Objectives	Relevant Actions	Evaluation	EPO, Controls and PS
Grey Nurse Shark Recovery Plan	**Objective 7**: Improve understanding of the threat of pollution and disease to the grey nurse shark	**Action 7.1**: Review and assess the potential threat of introduced species, pathogens and pollutants	Refer **Sections 6.7.8, 6.7.6** **Not inconsistent assessment**: This EP includes an assessment of the impacts from accidental release of solid wastes as well as planned discharges of drilling waste on marine species.	N/A
			Refer **Sections 6.6.4, 6.6.5, 6.6.6, 6.7.2, 6.7.3, 6.7.4, 6.7.5, 6.7.6, 6.7.7, 6.7.8** **Not inconsistent assessment**: The assessment of accidental release of chemicals / hydrocarbons has considered the potential risks to grey nurse sharks.	**Section 7.9** Detailed oil spill preparedness and response performance outcomes, standards and measurement criteria for the Petroleum Activities Program are present in **Appendix D**
Assessment Summary The Grey Nurse Shark Recovery Plan has been considered during the assessment of impacts and risks, and the Petroleum Activities Program is not considered to be inconsistent with the relevant actions of this plan.				

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Table 6-21: Assessment against relevant actions of the Sawfish and River Shark Recovery Plan

Part 13 Statutory Instrument	Relevant Action Areas/Objectives	Relevant Actions	Evaluation	EPO, Controls and PS
Sawfish and River Shark Recovery Plan	**Objective 5**: Reduce and, where possible, eliminate adverse impacts of habitat degradation and modification on sawfish and river shark species	**Action 5c**: Identify risks to important sawfish and river shark habitat and measures needed to reduce those risks	Refer **Sections 6.6.4, 6.6.5, 6.6.6, 6.7.2, 6.7.3, 6.7.4, 6.7.5, 6.7.6, 6.7.7** **Not inconsistent assessment**: The assessment of accidental release of chemicals / hydrocarbons has considered the potential risks to sawfish and river shark.	Refer **Section 7.9** Detailed oil spill preparedness and response performance outcomes, standards and measurement criteria for the Petroleum Activities Program are present in **Appendix D**
	Objective 6: Reduce and, where possible, eliminate any adverse impacts of marine debris on sawfish and river shark species	**Action 6a**: Assess the impacts of marine debris including ghost nets, fishing gear and plastics on sawfish and river shark species	Refer **Section 6.7.8** **Not inconsistent assessment**: The assessment of the accidental release of solid hazardous and non-hazardous wastes has considered the potential risks to sawfish. Controls have been implemented to reduce the likelihood of accidental release of solid wastes for the duration of the petroleum activities program.	N/A

Assessment Summary

The Sawfish and River Shark Recovery Plan has been considered during the assessment of impacts and risks, and the Petroleum Activities Program is not considered to be inconsistent with the relevant actions of this plan.

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Table 6-22: Assessment against relevant actions of the Marine Debris Threat Abatement Plan

Part 13 Statutory Instrument	Relevant Action Areas/Objectives	Relevant Actions	Evaluation	EPO, Controls and PS
Marine Debris TAP	**Objective 2**: Understand the scale of marine plastic and microplastic impact on key species, ecological communities and locations	**Action 2.04**: Build understanding related to plastic and microplastic pollution	Refer **Section 6.7.8** **Not inconsistent assessment:** The assessment of the accidental release of solid hazardous and non-hazardous wastes has considered the potential risks to the marine environment. Controls have been implemented to reduce the likelihood of accidental release of solid wastes for the duration of the petroleum activities program.	N/A
Assessment Summary The Marine Debris TAP has been considered during the assessment of impacts and risks, and the Petroleum Activities Program is not considered to be inconsistent with the relevant actions of this plan.				

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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 that environmental risks and impacts are continually being reduced to ALARP and are acceptable, and that EPOs and standards outlined in this EP are achieved.

Woodside, as Operator, is responsible for ensuring that the Petroleum Activities Program is managed in accordance with this Implementation Strategy and the WMS (see **Section 2.3**).

7.2 Systems, Practice, and Procedures

All operational activities are planned and performed in accordance with relevant legislation and standards, management measures identified in this EP and internal environment standards and procedures (**Section 6**).

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 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)*.

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Table 7-1: Roles and responsibilities

Title (role)	Environmental Responsibilities
Office-based Personnel	
Woodside Well Delivery Manager	• Monitor and manage the activity so it is performed as per the relevant standards and commitments in this EP and approval conditions. • Notify the Woodside Environment Adviser in a timely manner of any scope changes. • Liaise with regulatory authorities as required. • Review this EP as necessary and manage change requests. • Provide sufficient resources to implement the permanent plugging-related management measures (i.e. controls, EPOs, PSs and MC) in this EP. • Ensure MODU and support vessel personnel are given an HSE Induction as per **Section 7.4.2** of this EP at the start of the permanent plugging programs. • Verify that contractors meet environmental related contractual obligations. • Confirm controls and performance standards in this EP are actioned, as required, before permanent plugging commences. • Ensure the MODU start-up meets the requirements of the Drilling and Managing Rig Operations Process. • Confirm environmental incident reporting meets regulatory requirements (as outlined in this EP) and Woodside's HSE Reporting and Investigation Procedure. • Monitor and close out corrective actions identified during environmental monitoring or audits.

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Title (role)	Environmental Responsibilities
Subsea Delivery Manager	• Monitor and manage the activity so it is performed as per the relevant standards and commitments in this EP and approval conditions. • Notify the Woodside Environment Adviser in a timely manner of any scope changes. • Liaise with regulatory authorities as required. • Provide sufficient resources to implement the subsea related management measures (i.e. controls, EPOs, PSs and MC) in this EP. • Ensure vessel personnel are given an HSE Induction, as per **Section 7.4.2**, of this EP at the start of the activities. • Verify that contractors meet environmental related contractual obligations. • Confirm controls and performance standards in this EP are actioned, as required, before activities commence. • Ensure relevant vessels meet the requirements of Woodside's Marine Operations Operating Standard. • Review this EP and manage change requests for the activity. • Confirm that site-based personnel are given an HSE Induction, as per **Section 7.4.2**, of this EP at the start of the activity. • Ensure all chemicals and drill fluids proposed to be discharged are assessed and approved as per the requirements of the EP. • Confirm environmental incident reporting meets regulatory requirements (as outlined in this EP) and Woodside's HSE Reporting and Investigation Procedure. • Monitor and close out corrective actions identified during environmental monitoring or audits.
Woodside Drilling Superintendent	• Ensure the permanent plugging program meets the requirements detailed in this EP. • Ensure changes to the permanent plugging program are communicated to the Woodside Environmental Adviser. • Ensure Woodside's Well Site Manager is provided with the resources required to ensure the management measures (i.e. controls, EPOs, EPs and MC) in this EP are implemented. • Confirm environmental incident reporting meets regulatory requirements (as outlined in this EP) and Woodside's HSE Reporting and Investigation Procedure. • Monitor and close out corrective actions identified during environmental monitoring or audits.
Woodside Drilling, Completion and Subsea Engineers	• Ensure changes to the permanent plugging program are communicated to the Woodside Environmental Adviser. • Ensure all drilling and completions fluid chemical components and other fluids that may be used downhole have been reviewed by the Drilling and Completions Environmental Adviser.

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Title (role)	Environmental Responsibilities
Woodside Environmental Adviser	• Verify relevant Environmental Approvals for the activities exist before 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 the review, investigation and reporting of environmental incidents. • Ensure environmental monitoring and inspections/audits are performed as per the requirements of this EP. • Liaise with relevant regulatory authorities as required. • Assist in preparing required external regulatory reports, in line with environmental approval requirements and Woodside incident reporting procedures. • Monitor and close out corrective actions (Campaign Action Register) identified during environmental monitoring or audits. • Provide advice to relevant Woodside personnel and contractors to help them understand their environment responsibilities. • Liaise with 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. • Continuously liaise and provide notification as required as outlined in the EP.
Woodside Marine Assurance Superintendent	• Conduct relevant audit and inspection to confirm vessels comply with relevant Marine Orders and Woodside Marine Charters Instructions requirements to meet safety, navigation and emergency response requirements.
Woodside Corporate Incident Coordination Centre (CICC) Duty Manager	On receiving notification of an incident, the Woodside CICC Duty Manager shall: • Establish and take control of the Incident Management Team and establish an appropriate command structure for the incident. • Assess the situation, 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 (IAP) including objectives for action. • Approve, implement and manage the IAP. • Communicate within and beyond the incident management structure. • Manage and review safety of responders. • Address the broader public safety considerations. • Conclude and review activities.
MODU -based Personnel	

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Title (role)	Environmental Responsibilities
MODU Offshore Installation Manager (OIM)	• Ensure the MODU's management system and procedures are implemented. • Ensure personnel starting work on the MODU receive an environmental induction that meets the requirements specified in this EP. • Ensure personnel are competent to perform the work they have been assigned. • Verify that emergency drills are conducted as per the MODU's schedule. • Ensure the MODU's Emergency Response Team has been given sufficient training to implement the MODU's SOPEP. • Ensure any environmental incidents or breaches of outcomes or standards are reported immediately to the Well Site Manager. • Ensure corrective actions for incidents or breaches are developed, communicated to the Well Site Manager, and tracked to close-out in a timely manner.
Woodside Well Site Manager	• Ensure the permanent plugging program is performed as detailed in this EP. • Ensure the management measures (i.e. controls, EPOs, PSs and MC) detailed in this EP (relevant to offshore activities) are implemented on the MODU (other controls will be implemented onshore). • Ensure environmental incidents or breaches of outcomes or standards are reported as per the Woodside Corporate Event Notification Matrix. Ensure corrective actions for incidents and breaches are developed, tracked and closed out in a timely manner. • Ensure actions in the Drilling and Completions HSE Improvement Plan are performed. • Ensure periodic environmental inspections/reviews are completed. Ensure corrective actions from inspections are developed, tracked and closed out in a timely manner.
Woodside Offshore HSE Adviser	• Support the Well Site Manager to ensure the controls detailed in this EP relevant to offshore activities are implemented on the MODU, and help collect and record evidence of implementation (other controls are implemented and evidence collected onshore). • Support the Well Site Manager to ensure the EPOs are met and the PSs detailed in this EP are implemented on the MODU. • Confirm actions in the Drilling and Completions HSE Improvement Plan are performed. • Support the Well Site Manager to 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 Environment Adviser.
Drilling Logistics Coordinator	• Ensure waste is managed on the MODU and sent to shore as per the Drilling and Completions Waste Management Plan (WMP).
Vessel-based Personnel	

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Title (role)	Environmental Responsibilities
Vessels 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. • Verify 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 EPOs or PSs detailed in this EP are reported immediately to the Woodside Well Site Manager. • Ensure corrective actions for incidents or breaches are developed, communicated to the Well Site Manager, and tracked to close-out in a timely manner. Ensure close-out of actions is communicated to the Well Site Manager.
Vessel Logistics Coordinators	• Ensure waste is managed on the relevant support vessels and sent to shore as per the relevant WMP.
Vessel HSE Advisers	Refer to Woodside HSE Offshore Adviser responsibilities detailed above under MODU-based personnel.
Contractor Project Manager	• Confirm activities are performed in accordance with this EP, as detailed in the Woodside-approved Contactor Environmental Management Plan. • 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 Responsible Engineer or Vessel Master.

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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 systems to determine the level of compliance with the standard AS NZ ISO 14001. This assessment is performed for the Petroleum Activities Program as part of the pre-mobilisation process. The assessment determines whether there is a clearly defined organisational structure that clearly defines the roles and responsibilities for key positions. The assessment also assesses 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 Activities Program Specific Environmental Awareness

Before commencing the subsea campaigns associated with the Petroleum Activities Program, a pre-activity meeting will be held on-board MODU and project vessels 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. Attendance lists are recorded and retained.

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

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7.4.4 Management of Training Requirements

All personnel on the MODU and 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 performed and identifying minimum training requirements.

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

7.5.1 Monitoring

Woodside and its contractors will perform a program of periodic monitoring during the Petroleum Activities Program – starting at mobilisation of each activity and continuing through the duration of each activity to activity completion. This information will be collected using the tools and systems outlined below, developed based on the EPOs, controls, standards and MC in this EP. The tools and systems will collect, as a minimum, the data (evidence) referred to in the MC in **Section 6** and **Appendix D**.

The collection of this data (against the MC) will form part of the permanent record of compliance maintained by Woodside and will form the basis for demonstrating that the EPOs 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.
- Use of contractor’s risk identification program that requires personnel to record and submit safety and environment risk observation cards routinely (frequency varies with contractor).
- Collection of evidence of compliance with the controls detailed in the EP relevant to offshore activities by the Woodside Offshore HSE Adviser (other compliance evidence is collected onshore).
- Environmental discharge reports that record volumes of planned and unplanned discharges downhole (in the well), to ocean and atmosphere.
- Monitoring of progress against the Drilling and Completion function scorecard for KPIs.
- 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 Management of Knowledge

Review of knowledge relevant to the existing environment is undertaken in order to identify changes relating to the understanding of the environment or legislation that supports the risk and impact assessments for EPs (in-force and in-preparation). Relevant knowledge is defined as:

- Environmental science supporting the description of the existing environment.
- Socio-economic environment and stakeholder information.
- Environmental legislation.

The frequency and documentation of reviews, communication of relevant new knowledge and consideration of management of change are documented in the WMS Environment Plan Guideline.

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Under the Oil Spill Scientific Monitoring Program 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 potential new, or changes to existing 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 Performance Outcomes, Controls and Standards detailed in this EP.

Internal auditing will be performed to cover each key project activity as summarised below.

7.5.2.1 MODU Activities

Internal auditing is performed on a MODU-specific schedule, rather than a schedule to align with each well. This enables continuous review and improvement of environmental performance over the term of the MODU contract. The following internal audits, inspections and reviews will be performed to review the environmental performance of the activities:

- Survey environment rig equipment for a newly contracted MODU (if not previously contracted to Woodside within the last two years) against Woodside's Engineering Standard – Rig Equipment. This standard covers functional and technical requirements for Woodside contracted rigs and their associated equipment. An environment rig equipment survey scope typically includes mud and solids control systems, environmental discharge control (including drainage management), and loss of containment management.
- Complete a minimum of monthly environmental inspection (conducted by offshore Woodside personnel or a delegate) which may include verifying:
    - bunkering/transfers between support vessels and MODU /project vessels
    - environment containment including chemical storage, spill response equipment and housekeeping
    - general MODU environment risks including waste management, drilling fluids oil/water separation, and inspection of subsea and moonpool areas.
- Perform at least one environment audit during the Petroleum Activities Program, while the MODU is on location (by a Woodside Environment Adviser or delegate), which may include:
    - operational compliance audits relevant to environmental risk of activities which may include compliance with training commitments, discharge requirements, bunkering activities, verification of use of approved chemicals, and satisfactory close out of items from previous audits
    - inspection of selected risk areas/activities (which may include shaker house, drill floor and mud management while commencing riser drilling or reservoir interception) during routine MODU visits throughout the MODU campaign, determined by risk, previous incidents or operation specification requirements.

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7.5.2.2 Subsea Scope Activities

The following internal auditing will be performed for the subsea scope activities:

- Pre-mobilisation inspection/audit report will be conducted by a relevant person (before commencing). The scope of the audits are risk-based and specific to the relevant activity, but will generally focus on aspects relating to ensuring appropriate understanding of environmental commitments and the operational readiness of the activity scope, including appropriate environmental controls in place. All primary vessels associated with the above scopes will be audited by Woodside. Support or transport vessels will be assessed on a risk-based approach, but will be audited via the primary subsea installation contractor's process.
- At least one operational compliance audit relevant to applicable EP commitments will be conducted by a Woodside Environment Adviser for the subsea campaign. The audit may be conducted offshore or office-based, subject to the duration of the activity and logistics of performing the audit offshore for short duration scopes.
- Contractor-specific HSE audits will also be conducted of the associated support vessels. The audits will consider the implementation of HSE management, risk management, as well as pre-mobilisation and offshore readiness.
- Vessel-based HSE inspections will be conducted fortnightly by vessel HSE personnel. Each inspection will focus on a specific risk area relevant to the project activity and a formal report will be issued (for example, bunkering controls, chemical and discharge management, cetacean reporting, etc.).

The internal audits and reviews, combined with the ongoing monitoring described in **Section 7.5.1**, and collection of evidence for MC are used to assess EPOs 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.

This Environmental Commitments and Actions Register is used to track subsea support vessel and subsea activity compliance with EP commitments, including any findings and corrective actions.

Non-conformances identified will be reported and/or tracked in accordance with **Section 7.8.3** and **Section 7.8.4**.

7.5.2.3 Marine Assurance

Woodside's marine assurance is managed by the Marine Assurance Team of the Logisticsin accordance with Woodside's Marine Offshore Vessel Assurance Procedure. 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 (other than tankers and floating production storage and offloading vessels) hired for Woodside operations, including for short term hires (i.e. <3 months in duration). It defines applicable marine offshore assurance activities, ensuring 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)
- DP system verification

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- vessel inpsections
- OVID or condition and suitability assessment
- project support for tender review, evaluation and pre/post contract award.

Vessel inspections are used to verify actual levels of compliance with the company's Safety Management System, the overall condition of the vessel and the status of the planned maintenance system onboard. Woodside Marine Assurance Specialist will conduct a risk assessment on the vessel to determine the level of assurance applied and the type of vessel inspection required.

Methods of vessel inspection may include, and are not limited to:

- Woodside marine vessel inspection
- OCIMF OVID Inspection
- IMXA CMID Inspection
- Marine Warranty Survey

Upon completion of the marine assurance process, to confirm that identified concerns are addressed appropriately and conditions imposed are managed, the Woodside Marine Assurance Team will issue the vessel a statement of approval. Should a vessel not meet the requirements of the Woodside Marine Offshore Vessel Assurance Process and be rejected, there does exist an opportunity to further scrutinise the proposed vessel.

Where a vessel inspection and/or OVMSA verification review is not available and all reasonable efforts based on time and resource availability have been made to complete this (e.g. short term vessel hire), the Marine Assurance Specialist Offshore may approve the use of an alternate means of inspection, known as a risk assessment.

7.5.2.4 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, 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.

7.5.3 Management of Non-conformance

Woodside classifies non-conformances with EPOs 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 to record and report these incidents. Details of the event, immediate action taken to control the situation, investigation outcomes and corrective actions to prevent reoccurrence are all recorded. Corrective actions are monitored using 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 2.6.3**). Detailed investigations are completed for all categories A, B, C and high potential environmental incidents.

7.5.4 Review

7.5.4.1 Management Review

Within the Environment Function, senior management regularly monitor and review 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.

Woodside’s Drilling and Completions Environment Team will perform six-monthly reviews of the effectiveness of the implementation strategy and associated tools. This will involve reviewing the:

- Drilling and Completions environment KPIs (leading and lagging)
- Tools and systems to monitor environmental performance (detailed in **Section 7.5.1**)
- Lessons learned about implementation tools and throughout each campaign.
- Reviews of oil spill arrangements and testing are performed in accordance with **Section 7.9**.

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7.5.4.2 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 each well, including review of environmental incidents as relevant.
- Ongoing communication with MODU operators.
- Formal and informal industry benchmarking.
- Cross asset learnings.
- Engineering and technical authorities discipline communications and sharing.

7.5.4.3 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 MOC process outlined below (**Section 7.6**).

7.6 Management of Change and Revision

7.6.1 Environmental Plan Management of Change

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, DAWE EPBC Act listed threatened and migratory species status, Part 13 statutory instruments (recovery plans, threat abatement plans, conservation advice, wildlife conservation plans) and current requirements for AMPs (**Section 4**); and potential new advice from external stakeholders (**Section 5**), 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 2.6**) 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 formal 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, etc.), 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.

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7.6.2 OPEP Management of Change

Relevant documents from the OPEP will be reviewed in the following circumstances:

- implementation of improved preparedness measures
- a change in the availability of equipment stockpiles
- a change in the availability of personnel that reduces or improves preparedness and the capacity to respond
- the introduction of a new or improved technology that may be considered in a response for this activity
- to incorporate, where relevant, lessons learned from exercises or events
- if national or state response frameworks and Woodside's integration with these frameworks changes.

Where changes are required to the OPEP, based on the outcomes of the reviews described above, they will be assessed against Regulation 17 to determine if EP, including OPEP, resubmission is required (see **Section 7.6.1**). Changes with potential to influence minor or technical changes to the OPEP are tracked in management of change records, project records and incorporated during internal updates of the OPEP or the five-yearly revision.

7.7 Record Keeping

Compliance records (outlined in MC in **Section 6)** will be maintained.

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

7.8 Reporting

To meet the EPOs 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 drilling activities are prepared and issued to key support personnel and stakeholders, by relevant managers responsible for the well. The report provides performance information about drilling activities, heath, safety and environment, 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 resolving issues.

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 (e.g. Drilling and Completions). These reports cover a number of subject matters, including:

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- HSE incidents (including high potential incidents and those related to this EP) and recent activities
- Corporate KPI 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 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 about 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	NOPSEMA	Monthly, by the 15th of each month.	Details of recordable incidents that have occurred during the Petroleum Activities Program for previous month (if applicable).
Environmental Performance Report	NOPSEMA	Annually, with the first report submitted within 12 months of the commencement of the Petroleum Activities Program covered by this EP (as per the requirements of Regulation 14(2).	Compliance with EPOs, controls and standards outlined in this EP, in accordance with the Environment Regulations.

7.8.2.3 End of the Environmental 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 completed, and NOPSEMA has accepted the notification, in accordance with Regulation 25A of the Environment Regulations.

7.8.3 Incident Reporting (Internal)

The process for reporting environmental incidents is described in **Sections 7.8.3** and **7.8.4** of this EP. It is the responsibility of the Woodside Project Manager to ensure reporting of environmental incidents meets Woodside and regulatory reporting requirements as detailed in the Woodside HSE Event Reporting and Investigation Procedure and this section of this EP.

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 significant environmental damage'.

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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**)).
- The environmental risk assessment (**Section 6**) for the Petroleum Activities Program identifies those risks with a potential consequence level of C+ for environment. The incidents that have the potential to cause this level of impact include hydrocarbon loss of containment events to the marine environment resulting from a loss of well integrity.
- Any such incidents represent potential events which would be reportable incidents. Incident reporting is performed with consideration of NOPSEMA (2014) guidance stating, 'if in doubt, notify NOPSEMA', and assessed on a case-by-case basis 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) ASAP, 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 (NOPTA) and the Department of the responsible State Minister (DMIRS) ASAP after orally reporting the incident
- Complete a written report for all reportable incidents using a format consistent with the NOPSEMA Form FM0831 – Reportable Environmental Incident (**Appendix E**) which must be submitted to NOPSEMA ASAP, but within three days of the incident or of its detection by Woodside
- Provide a copy of the written report to the NOPTA and DMIRS, within seven days of the written report being provided to NOPSEMA.
- AMSA will be notified of oil spill incidents ASAP after their occurrence, and DAWE notified if MNES are to be affected by the oil spill incident.

7.8.4.2 Recordable Incidents

Definition

A recordable incident as defined under Regulation 4 of the Environment Regulations is 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), no later than 15 days after the end of the calendar month using the NOPSEMA Form – Recordable Environmental Incident Monthly Summary Report detailing:

- 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.

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- 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 Operational Area.

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Table 7-3: External Incident Reporting Requirements

Event	Responsibility	Notifiable party	Notification requirements	Contact	Contact detail
Any marine incidents during Petroleum Activities Program	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 Rescue Coordination Centre (RCC)	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 RCC Australia	If the ship is at sea, reports are to be made to: Free call: 1800 641 792 Phone: 08 9430 2100 (Fremantle)
Oil pollution incidents in Commonwealth waters	Vessel Master	AMSA	Without delay as per *Protection of the Sea Act*, part II, section 11(1), AMSA RCC notified verbally via the national emergency 24-hour notification contact of the hydrocarbon spill; follow up with a written Pollution Report ASAP after verbal notification	RCC 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	Vessel Master	DAWE	Reported verbally, ASAP	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	Vessel Master	DAWE	Within seven days of becoming aware	Secretary of the DAWE	Phone: 1800 803 772 Email: protected.species@environment.gov.au

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The pollution activities should also be reported to AMSA via RCC Australia by the Vessel Master are:

- 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 Balnaves Plug and Abandonment Oil Pollution First Strike Plan (**Appendix I**).
- External incident reporting requirements under the *OPGGS (Safety) Regulations*, including under Subregulation 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 Oil Pollution Emergency Plan (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 (**Appendix D**)
Describes the OPEP	Regulation 14(8)	EP: Woodside’s oil pollution emergency plan has the following components: • Woodside Oil Pollution Emergency Arrangements (Australia) • Oil Pollution First Strike Plan (**Appendix I**) • Oil Spill Preparedness and Response Mitigation Assessment (**Appendix D**) • In accordance with Regulation 31 of the Environmental Regulations the Woodside Oil Pollution Emergency Arrangements (Australia) was provided with the Julimar Phase 2 Drilling and Subsea Installation EP, accepted by NOPSEMA on 8 November 2019.
Details 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 (**Appendix D**) • Oil Pollution First Strike Plan (**Appendix I**)

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Content	Environment Regulations Reference	Document/Section Reference
Details the arrangements for updating and testing the oil pollution response arrangements	Regulation 14(8), (8A), (8B), (8C)	- EP: **Section 7.9.5** - Oil Spill Preparedness and Response Mitigation Assessment (**Appendix D**)
Details of provisions for monitoring impacts to the environment from oil pollution and response activities	Regulation 14(8D)	Oil Spill Preparedness and Response Mitigation Assessment **(Appendix D**)
Demonstrates that the oil pollution response arrangements are consistent with the national system for oil pollution preparedness and control	Regulation 14(8E)	Oil Pollution Emergency Arrangements (Australia)

7.9.2 Emergency Response Training

Regulation 14(5) requires that the implementation strategy includes measures to ensure that employees and contractors have the appropriate competencies and training. Woodside has conducted a risk-based training needs analysis on positions required for effective oil spill response. Following the mapping of training to Woodside identified competencies, training was then mapped to positions based on their required competencies.

Table 7-5: Minimum levels of competency for key IMT positions

IMT Position	Minimum Competency
Corporate Incident Coordinate Centre (CICC) Leader	- Incident and Crisis Leadership Development Program (ICLDP) - Oil Spill Response Skills Enhancement Course (OSREC – internal course) - Participation in L2 oil spill exercise (initial) - Participation in L2 oil spill exercise (refresher)
Security & Emergency Manager Duty Manager	- ICLDP - OSREC - IMO2 or equivalent spill response specialist level with an oil spill response organisation (OSRO) - Participation in L2 oil spill exercise (initial) - Participation in L2 oil spill exercise (refresher)
Operations, Planning, Logistics, Safety	- OSREC - ICC Fundamentals Course (internal course) - Participation in L2 oil spill exercise (initial) - Participation in L2 oil spill exercise (refresher)
Environment Coordinator	- ICC Fundamentals - OSREC - IMO2 or equivalent spill response specialist level with an OSRO - Participation in L2 oil spill exercise (initial) - Participation in L2 oil spill exercise (refresh
Note on competency/equivalency	
In 2018 Woodside undertook a review of incident and crisis systems, processes and tools to assess whether these were fit-for purpose and has rolled out a change to the Incident and Crisis Management training and the oil spill response training requirements for both ICC and field-based roles. The revised ICC Fundamentals training Program and Incident and Crisis Leaders Development Program (ICLDP) align with the performance requirements of the *PMAOMIR320 – Manage Incident Response Information* and *PMAOM0R418 - Coordinate Incident Response.*	

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Regarding training specific equivalency;

- ICLDP is mapped to *PMAOM0R418* (and which is equivalent to IMOIII when combined with Woodside's OSREC course) and ensures broader incident management principles aligned with Australasian Inter-service Incident Management System (AIIMS).
- The revised ICC Fundamentals Course is mapped to *PMAOMIR320* (and which is equivalent to IMOII). The blended learning program offers modules aligned to IMOIII, IMOII, IMOI and AMOSC Core Group Training Oil Spill Response Organisation Specialist Level training.
- OSREC involves the completion of two (2) online AMSA Modules (Introduction to National Plan and Incident management; and Introduction to oil spills) as well as elements of IMOI and IMOII tailored to Woodside specific OSR capabilities.
- Woodside Learning Services (WLS) are responsible for collating and maintaining personnel training records. The HSP Dashboard reflects the competencies required for each oil spill role (IMT/operational).

7.9.3 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 Leader, supports the site-based Incident Management Team (IMT) by providing additional support in areas such as operations, logistics, planning, people management and public information (corporate affairs). A description of Woodside's Incident Command Structure and arrangements is further detailed in the Woodside Oil Pollution Emergency Arrangements (Australia).

Woodside will have an Emergency Response Plan (ERP) in place relevant to the Petroleum Activities Program. The ERP provides procedural guidance specific to the asset and location of operations to control, coordinate and respond to an emergency or incident. For a drilling activity, the ERP will be a bridging document to the contracted rig's emergency documentation. This document summarises the emergency command, control and communications processes for the integrated operation and management of an emergency. It is developed in collaboration with the contracted rig and ensures roles and responsibilities between the contracted rig and Woodside personnel are identified and understood. The ERPs 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:

- On the MODU the OIM will assume overall onsite command and act as the Incident Controller (IC). All persons aboard the MODU will be required to act under the IC's directions. The MODU/vessels will maintain communications with the onshore Drilling Superintendent 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.
- Vessel Master (depending on the location of the emergency) will assume overall onsite command and act as the 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.
- The MODU and project vessels will have on-board equipment for responding to emergencies including medical equipment, fire-fighting equipment and oil spill response equipment.

7.9.4 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 result in a serious safety or environmental incident and cause asset and reputational damage if not managed properly. The Woodside Oil Pollution

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Emergency Arrangements (Australia) document, supported by the Oil Pollution First Strike Plan (**Appendix I**) and activity SCERP which provide tactical response guidance to the activity/area and **Appendix D** this EP, cover spill response for this Petroleum Activities Program.

The Security and Emergency Management Function is responsible for managing Woodside's hydrocarbon 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 a Memorandum of Understanding in place to support Woodside in the event of an oil spill.

The Oil Pollution First Strike Plan and activity SCERP provide immediate actions required to commence a response (**Appendix I**).

The MODU and 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 EPOs, performance standards and MC to be used for oil spill response during the Petroleum Activities Program, as detailed in **Appendix D**.

7.9.5 Emergency and Spills Response

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

7.9.5.1 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.

7.9.5.2 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 by activating all or part of the responsible CICC.

7.9.5.3 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, or livelihood. 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 and commercial, reputation etc.). The CICC may also be activated as required to manage the operational incident response.

7.9.6 Source Control Response Capability

Source Control IMT Structure

The Woodside Incident and Crisis Management Structure is outlined in the Woodside Oil Pollution Emergency Arrangements (Australia). In a Level 3 Incident, the Source Control Functional Support Team (FST) will be formed reporting to the Operations Coordinator. The structure of the Source Control FST is shown in **Figure 7-1**.

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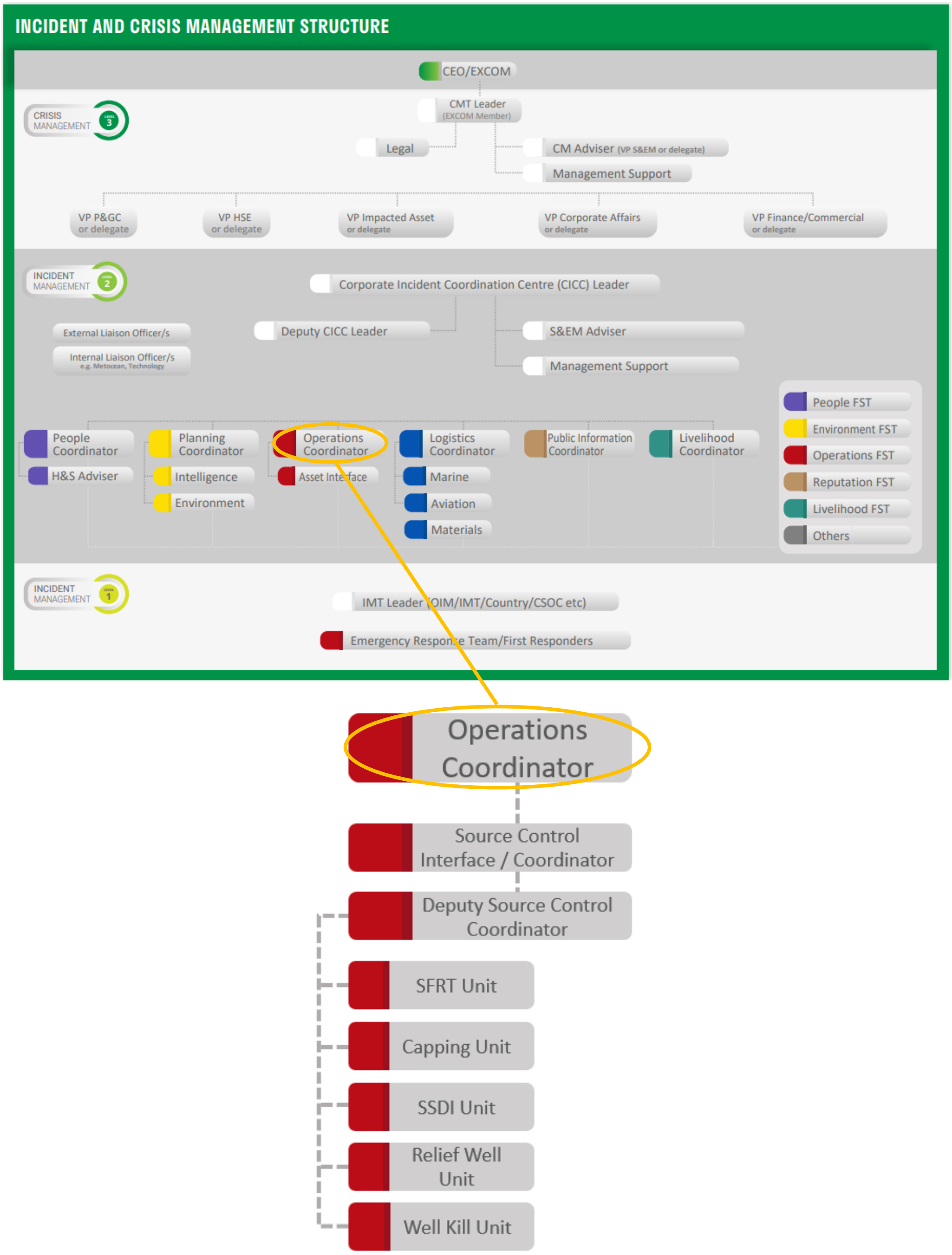

Figure 7-1: Source Control Functional Support Team structure

Roles and responsibilities of the Source Control FST Leaders are summarised in **Table 7-6**.

Table 7-6: Source Control Functional Support Team roles and responsibilities

Role	Key Responsibilities
Source Control Coordinator	• Activate Source Control responses • Approve operational plans

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	• Manage Source Control FST • Report to Operations Coordinator
Deputy Source Control Coordinator	• Approve operational plans • Manage Source Control Function and ensure coordination among groups/units
Subsea First Response Toolkit (SFRT) Unit Coordinator	• Mobilise vessel with work class ROVs • Survey and attempt to function BOP • Debris clearance survey and operations
Capping Unit Coordinator	• Mobilise capping stack and support equipment • Assemble and test capping stack for deployment • Hydrate remediation • Capping stack operations as required
Subsea Dispersant Injection (SSDI) Unit Coordinator	• Develop dispersant application and monitoring plans • Apply for local Government approvals • Conduct subsea dispersant application and monitoring operations
Relief Well Unit Coordinator	• Determine if impacted rig may be utilised for relief rig or capping stack deployment • Determine number of relief wells to be drilled • Obtain and assess information on reservoir and wellbore geometry • Coordinates mobilisation of relief well rig(s) and execution of relief well(s)
Well Kill Unit Coordinator	• Obtain and review reservoir and wellbore data • Determine kill weights and pumping rates • Develop the well kill plan • Conduct kill operations

The Source Control units described in **Figure 7-1**, may include the following support positions:

- HSE Adviser/s
- Well Delivery Manager/s
- Subsea Manager/s
- D&C Superintendent/s
- Subsea Vessel Superintendent/s
- Lead D&C and Subsea Engineers
- D&C Engineering support, as required
- Subsea Engineering support, as required
- Contractor Representatives including source control contractors
- Logistics Coordinator/s

7.9.6.1 Source Control Response Personnel Resourcing and Competency

All Source Control unit leader positions will be filled with Woodside personnel from the Subsea and Pipeline (SSPL) and Drilling and Completions (D&C) Departments.

All personnel will hold a relevant tertiary qualification, well control certifications and industry experience commensurate with the position being held.

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Initial Source Control functional response will typically be led by a Subsea and Pipeline Manager or Well Delivery Manager in the role of the Source Control Coordinator and the remaining FST roles would be filled by suitably experienced people, sourced from the operational team and across the broader SSPL and D&C functions.

The Source Control teams will be scaled with additional resources depending on the specifics of the scenario. As the emergency response duration increases suitable arrangements will be made to establish shifts and duty roster cycles to ensure ongoing functional support. Woodside has access to sufficient personnel to cover 24 hour operations on a rolling roster through existing personnel capabilities.

The Source Control IMT response structure indicated in **Figure 7-1** is estimated to require from 4 up to 12 positions per shift varying with the scale of response, 8 to 24 positions for 24 hour coverage. For an prolonged response resources to provide on/off weekly cycles, an additional 8 to 24 positions will be required, totalling 16 to 48 positions over the scale of response. These numbers are indicative and will vary depending on scale and complexity of operations.

The current organisational review indicates Woodside have > 80 internal staff members to support the Source Control IMT positions. In the event of a level 3 incident, response activities will be given priority and other projects may be reduced or suspended allowing reallocation of significant additional resources. Woodside would require access to external resources primarily for Specialist Services and Expertise in Source Control / Well Control operations.

Additional personnel to support the Source Control FST will be filled through the following avenues:

- Well Control Specialists through existing contracts e.g. Wild Well Control, Add Energy
- Secondment of Personnel from other Titleholders through APPEA Industry Memorandum of Understanding (2021)
- Engineering support through call-off frame agreements.

Following personnel call-off, online briefings will be held for external personnel prior to commencing work. If building access is required, onboarding will commence as per the Woodside`s Office Access Management Procedures. In the event of an emergency, building access can be expedited at the discretion of the CICC or identified senior leaders and facilities for remote operations would also be set up.

7.9.7 Emergency and Spill Response Drills and Exercises

Woodside’s capability to respond to incidents will be tested periodically, in accordance with the Emergency and Crisis Management Procedure. The scope, frequency and objective of these tests is described in **Table 7-7**. Emergency response testing 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 reference points developing and scheduling emergency and crisis management exercises. External participants may be invited to attend exercises (e.g. government agencies, specialist service providers, oil spill response organisations, or industry members with which Woodside has mutual aid arrangements).

The overall objective of exercises is to test procedures, skills and the teamwork of the Emergency Response and Command Teams in their ability to respond to major accident / major environment events. After each exercise, the team holds a debriefing session, during which the exercise is reviewed. Any lessons learned or areas for improvement are identified and incorporated into revised procedures, testing of arrangements register and OPEP, where appropriate.

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Table 7-7: Testing of response capability

Response Category	Scope	Response Testing Frequency	Response Testing Objective
Level 1 Response	Exercises are MODU/ vessel specific	One Level 1 'First Strike' drill conducted within two weeks of activity commencement [Note a Level 1 drill must be conducted within two weeks of the campaign commencing and then at least every 6 month hire period thereafter]	• Comprehensive exercises test elements of the Oil Pollution First Strike Plan (**Appendix I**). • Emergency drills are scheduled to test other aspects of the Emergency Response Plan.
Level 2 Response	Exercises are MODU specific	A minimum of one Emergency Management exercise per MODU per campaign [must be conducted within one month of campaign commencing and at least one Level 2 exercise per 6 month hire period].	• Testing both the facility IMT response and/or that of the CICC following handover of incident control. Exercises may include testing of Source Control Response Strategies.
Level 3 Response	Exercises are relevant to all Woodside assets	The number of CMT exercises conducted each year is determined by the Chief Executive Officer, in consultation with the Vice President of Security and Emergency Management.	• Test Woodside's ability to respond to and manage a crisis level incident.

7.9.8 Hydrocarbon Spill Response Testing of Arrangements

Woodside is required to test hydrocarbon spill response arrangements as per regulations 8B and 8C of the Environment Regulations. Woodside's arrangements for spill response are common across its Australian operating assets and activities to ensure the controls are consistent. The overall objective of testing these arrangements is to ensure that Woodside maintains an ability to respond to a hydrocarbon spill, specifically to:

- Ensure relevant responders, contractors and key personnel understand and practise their assigned roles and responsibilities.
- Test response arrangements and actions to validate response plans.
- Ensure lessons learned are incorporated into Woodside's processes and procedures and improvements are made where required.

If new response arrangements are introduced, or existing arrangements significantly amended, additional testing is undertaken accordingly. If the MODU leaves the field for an extended period, additional testing will be undertaken when it returns to routine operations. Additional activities or activity locations are not anticipated to occur; however, if they do, testing of relevant response arrangements will be undertaken as soon as practicable.

In addition to the testing of response capability described in **Table 7-7**, up to eight formal exercises are planned annually, across Woodside, to specifically test arrangements for responding to a hydrocarbon spill to the marine environment.

7.9.8.1 Testing of Arrangements Schedule

Woodside's Testing of Arrangements Schedule (**Figure 7-2**) 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. If a spill occurs, enacting these arrangements will underpin Woodside's ability to implement a response across its petroleum activities. **Figure 7-2** shows a condensed snapshot of Woodside's 5-year rolling Testing of Arrangements Schedule.

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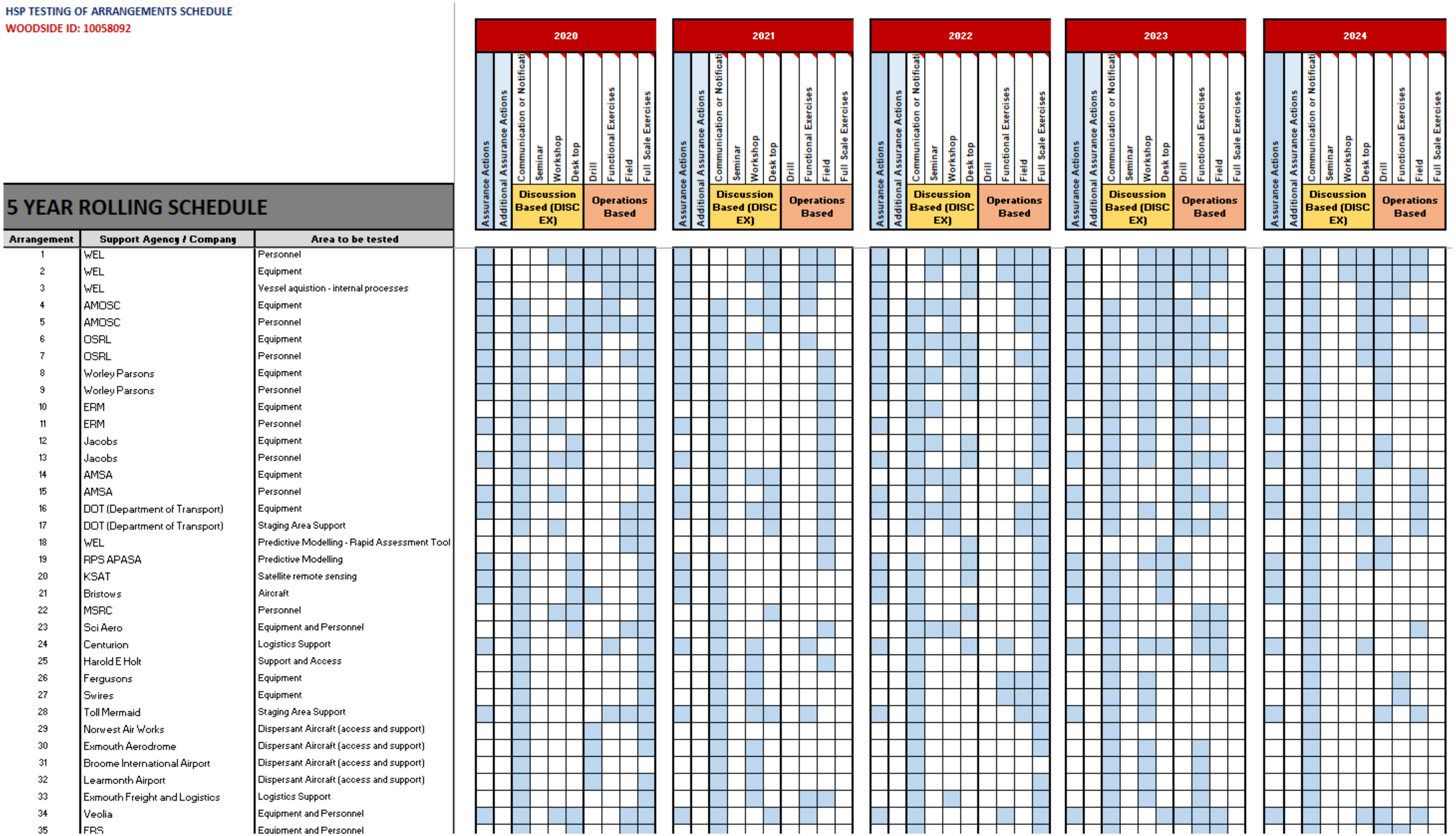

HSP TESTING OF ARRANGEMENTS SCHEDULE
WOODSIDE ID: 10058092

5 YEAR ROLLING SCHEDULE

Arrangement	Support Agency / Company	Area to be tested
1	WEL	Personnel
2	WEL	Equipment
3	WEL	Vessel aquistion - internal processes
4	AMOSC	Equipment
5	AMOSC	Personnel
6	OSRL	Equipment
7	OSRL	Personnel
8	Worley Parsons	Equipment
9	Worley Parsons	Personnel
10	ERM	Equipment
11	ERM	Personnel
12	Jacobs	Equipment
13	Jacobs	Personnel
14	AMSA	Equipment
15	AMSA	Personnel
16	DOT (Department of Transport)	Equipment
17	DOT (Department of Transport)	Staging Area Support
18	WEL	Predictive Modelling - Rapid Assessment Tool
19	RPS APASA	Predictive Modelling
20	KSAT	Satellite remote sensing
21	Bristows	Aircraft
22	MSRC	Personnel
23	Sci Aero	Equipment and Personnel
24	Centurion	Logistics Support
25	Harold E Holt	Support and Access
26	Fergusons	Equipment
27	Swires	Equipment
28	Toll Mermaid	Staging Area Support
29	Norwest Air Works	Dispersant Aircraft (access and support)
30	Exmouth Aerodrome	Dispersant Aircraft (access and support)
31	Broome International Airport	Dispersant Aircraft (access and support)
32	Learmonth Airport	Dispersant Aircraft (access and support)
33	Exmouth Freight and Logistics	Logistics Support
34	Veolia	Equipment and Personnel
35	FRS	Equipment and Personnel

Figure 7-2: Indicative 5-yearly testing of arrangements schedule

(Snapshot of a selection of oil spill response arrangements tested annually; Note: schedule is subject to change, additional detail is included in the live document)

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Numbered hydrocarbon spill arrangements listed in the rows of the schedule are taken from the support plans and operational plans described in **Section 1.4** of **Appendix D**. Each arrangement has a support agency/company and an area to be tested (e.g. capability, equipment and personnel). For example, an arrangement could be to test Woodside's personnel capability for conducting scientific monitoring, or the ability of the Australian Marine Oil Spill Centre to provide response personnel and equipment. About 75 hydrocarbon spill preparedness arrangements are tested annually across the eight planned exercises, as described above.

The vertical columns under each year in **Figure 7-2** relate to an individual exercise or additional assurance actions that are conducted over the 5-year rolling schedule. The sub-heading for the column describes the standard method of testing (e.g. discussion exercise, desktop exercise), and the blue cells indicate the arrangements that could be tested for each method.

Arrangements in the schedule are tested at least once a year; however, some arrangements may be tested across multiple exercises (e.g. critical arrangements) or via other 'additional assurance' methods outside the formal Testing of Arrangements Schedule that also constitute sufficient evidence of testing of arrangements (e.g. audits, no-notice drills, internal exercises, assurance drills) (refer to the first and second vertical columns for each year in **Figure 7-2**).

7.9.8.2 Exercises, Objectives, and KPIs

Exercises are designed to cumulatively provide assurance for all arrangements within Woodside's Testing of Arrangements Schedule annually across all facilities. Exercise-initiating scenarios are derived from the worst-case credible scenarios as described in the relevant facility's First Strike Plans.

Objectives and KPIs for each exercise are determined by reviewing:

- The Testing of Arrangements Schedule, which identifies which arrangements can be tested for each testing method (**Section 7.9.8.1**).
- The objectives and KPIs master generic plan, which summarises generic objectives and KPIs that could be tested for specific response strategies, based on industry good practice guidance (i.e. IPIECA) for testing oil spill arrangements.
- The oil spill ALARP commitments register, which summarises all spill response commitments from accepted EPs (e.g. timings, numbers) for different response strategies, and considers priority commitments and worst-cast spill scenarios.
- Actions undertaken from recommendations from previous exercises, where relevant.
- The required capabilities, number of personnel, equipment, and timeframes (i.e. arrangements) form specific KPIs during an exercise. Where this is the case, the ALARP commitments register indicates the specific response strategy performance standards to use/test the arrangements against. Where relevant the most stringent performance standard across all in-force EPs is used as the KPI. After each exercise, a report is produced that includes recommendations for improvements, which are then converted to actions and tracked in the Testing of Arrangements Register.

Additional assurance actions are also routinely undertaken outside formal exercises (e.g. response audits, no-notice drills), which support testing of these arrangements. Evidence and outcomes from additional assurance actions are used, where relevant, to support testing individual arrangements, including from external sources (e.g. evidence of suppliers testing their own arrangements).

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7.9.8.3 Source Control testing and exercise arrangements

This section aims to present the testing and exercise arrangements for Source Control techniques as recommended in the recent industry guidelines such as the APPEA *Australian Offshore Titleholders Source Control Guideline* (issued June 2021) and the NOPSEMA Information Paper: *Source Control Planning and Procedures* (issued June 2021)

The paragraphs below elaborate on the scope, testing frequency, objectives and close-out processes applicable to testing/ exercises for Source Control techniques.

Scope, objectives and KPIs

a. The objective of tests/ exercises is to verify the capability of Woodside and/or contractors to manage and deliver elements of the Source Control Plans presented in OPEP.

b. Tests may include specific elements of the response cycle for source control strategy, e.g. activation of arrangements, mobilisation of equipment and personnel and, if relevant, testing of specific operational plans (e.g. SFRT, capping and relief well).

c. Objectives may include; testing of IMT capabilities, communications requirements, testing of source control response plans and evaluating specific aspects of source control arrangements, e.g. number of personnel, equipment, mobilisation plans and timeframes for response.

d. KPIs are taken from the ALARP commitments as stated in the OSPRMA (**Appendix D**).

e. The exercises are planned utilising SMEs from the function with independent observers/ agencies as available (e.g. AMOSC, OSRL) along with Industry collaboration as available/ permitted.

f. Formal exercise plans are produced prior to tests and exercises to document the scope, objectives, allocate resources and select relevant plans and previous lessons learnt for the test or exercise.

g. **Table 7-7: Testing of response capability** provides indicative scope, testing frequency and objectives of the emergency and spill response drills and exercises which includes Source Control response techniques.

Frequency of tests

In addition to Testing of Arrangements for all responses listed in the Schedule, Source Control techniques are tested on an annual basis; at least one technique per year. The schedule for testing of Source Control techniques is included under **Section 7.9.8.1Testing of Arrangements Schedule**.

Woodside has tested the below response techniques in last two years:

- SSDI and Relief well response in 2019
- SFRT response (Joint Industry exercise hosted by Woodside) in 2020

Woodside plans to test:

- Capping response in Q4 2021.
- In addition, Woodside Source Control team members participate in Joint Industry exercises on Source Control as available for continuous improvements to response plans.

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Close out Processes

Post-exercise debriefs are held with the exercise team to identify gaps and capture learnings. The recommendations and actions are documented and assigned to the relevant function within the organisation and tracked until close-out. Close-out reports are distributed to relevant function leads and captured under Woodside's document management systems and relevant processes. Lessons learned are incorporated into Woodside's processes and procedures and improvements are made where required.

7.9.9 Cyclone and Dangerous Weather Preparation

As the timing of some activities associated with the Petroleum Activities Program are not yet determined, it is possible permanent plugging activities and subsea activities will overlap with the cyclone season (November to April, with most cyclones occurring between January and March). If undertaking activities within cyclone season, the MODU contractor and 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 MODU and project vessels will receive daily forecasts from the Bureau of Meteorology. 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).

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9. LIST OF TERMS AND ACRONYMS

Acronym	Description
~	Approximately
<	Less/fewer than
>	Greater/more than
≤	Less than or equal to
≥	Greater than or equal to
°	Degrees
°C	Degrees Celsius
3D	Three-dimensional
AFMA	Australian Fisheries Management Authority
AHO	Australian Hydrographic Office
AHS	Australian Hydrographic Service
AIS	Automatic Identification System
AHV	Anchor handling tug(s)
AHV	Anchor handling vessel(s)
ALARP	As low as reasonably practicable
AMP	Australian Marine Park
AMSA	Australian Maritime Safety Authority
API	American Petroleum Institute
ASAP	As soon as possible
AS/NZS	Australian Standard/New Zealand Standard
ATSB	Australian Transport Safety Bureau
AusSAR	Australian Search and Rescue
BAL	Balnaves
bbl	Barrel
bbl/hr	Barrels per hour
BIA	Biologically Important Area
BoM	Bureau of Meteorology
BOP	Blowout Preventer
CAES	Catch and Effort System
CCP	Cyclone Contingency Plan
CEFAS	United Kingdom Centre for Environment, Fisheries and Aquaculture Science
CHP	Commonwealth Heritage Place
CICC	Corporate Incident Communication Centre
CITES	Convention on International Trade in Endangered Species of Wild Fauna and Flora

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Acronym	Description
cm	Centimetre
cm^3	Cubic centimetre
CMT	Crisis Management Team
CO_2	Carbon dioxide
COLREGS	Convention on the International Regulations for Preventing Collisions at Sea
CoP	Cessation of Production
cP	Centipoise
CS	Cost Sacrifice
CV	Company Value
D&C	Drilling and Completions
DAA	Western Australian Department of Aboriginal Affairs
DAWE	Department of Agriculture, Water and the Environment
dB	Decibel
dB re 1 µPa	Decibels relative to one micropascal; the unit used to measure the intensity of an underwater sound
DEC	Department of Environment and Conservation
DHNRDT	Deepwater Horizon Natural Resource Damage Assessment Trustees
DMIRS	Western Australian Department of Mines, Industry Regulation and Safety
DMP	Western Australian Department of Mines and Petroleum (now Department of Mines, Industry Regulation and Safety)
DNP	Director of National Parks
DoEE	Commonwealth Department of the Environment and Energy (now DAWE)
DP	Dynamic positioning
DPIRD	Western Australian Department of Primary Industries and Regional Development
DSEWPaC	Former Commonwealth Department of Sustainability, Environment, Water, Population and Communities (now DAWE)
DTM	Disconnectable Turret Mooring
EAAF	East Asian-Australasian Flyway
EDS	Emergency Disconnect Sequence
EEZ	Exclusive Economic Zone
EMBA	Environment that may be affected
EMS	Environmental Management System
ENVID	Environment Identification (study)
EP	Environment Plan
EPBC Act	Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*
EPO	Environmental Performance Objective
EPS	Environment Performance Standard
ERP	Emergency Response Plan

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Acronym	**Description**
ESD	Ecologically Sustainable Development
ESDV	Emergency Shutdown Valve
F	Control feasibility
F-Pil	Flatback turtle – Pilbara stock
FPSO	Floating production, storage, and offtake
g	Gram
G-NWS	Green turtle – North West Shelf stock
GP	Good Practice
GWA	Goodwyn Alpha
H-WA	Hawksbill turtle – WA stock
HAZID	Hazard identification (study)
HFL	Hydraulic Flying Lead
HOCNF	Harmonised offshore chemical notification format
HP	High Pressure
HQ	Hazard Quotient
HSE	Health, Safety, and Environment
HSPU	Hydrocarbon Spill Preparedness Unit
HXT	Horizontal Xmas Tree
Hz	Hertz
IAATO	International Association of Antarctica Tour Operators
IAP	Incident Action Plan
IAPP	International Air Pollution Prevention
IC	Incident Controller
IMCRA	Integrated Marine and Coastal Regionalisation of Australia
IMO	International Maritime Organisation
IMR	Inspection, maintenance and repair
IMS	Invasive Marine Species
IMT	Incident Management Team
IOGP	International Association of Oil and Gas Producers
IOPP	International Oil Pollution Prevention
IPIECA	International Petroleum Industry Environmental Conservation Association
IS	Implementation Strategy
ISO	International Organization for Standardization
ISSP	International Sewage Pollution Prevention
ITOPF	International Tanker Owners Pollution Federation Ltd
IUCN	International Union for the Conservation of Nature
JRCC	Joint Rescue Coordination Centre

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Acronym	Description
JSA	Job Safety Analysis
KEF	Key Ecological Feature
kg	Kilogram
kHz	Kilohertz
km	Kilometre
KPI	Key Performance Indicator
L	Litre
LBL	Long baseline
lbs	Pounds
LCS	Legislation, Codes and Standards
LCV	Light construction vessel
LF	Low-frequency
LH-WA	Logger Head turtle – WA stock
LNG	Liquefied Natural Gas
LP	Low Pressure
LWIV	Light well intervention vessel
m	Metre
m^2	Square metre
m^3	Cubic metre
MARPOL	The International Convention for the Prevention of Pollution From Ships, 1973 as modified by the Protocol of 1978.
MC	Measurement Criteria
MDO	Marine diesel oil
MEG	Mono-ethylene glycol
MF	Mid-frequency
MFO	Marine Fauna Observer
mg	Milligram
MNES	Matters of National Environmental Significance
MODU	Mobile Offshore Drilling Unit
MPRA	Marine Parks and Reserves Authority
MSIN	Marine Safety Information Notification
N/A	Not Applicable
NERA	National Energy Resources Australia
NHP	National Heritage Place
NIMS	Non-indigenous Marine Species
NLPG	National Light Pollution Guidelines
nm	Nautical mile

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Acronym	Description
NMFS	National Marine Fisheries Service (US)
NOAA	National Oceanic and Atmospheric Administration (US)
NOPSEMA	National Offshore Petroleum Safety and Environmental Management Authority
NOPTA	National Offshore Petroleum Titles Administrator
NORM	Naturally Occurring Radioactive Material
NRC	North Rankin Complex
NT	Northern Territory
NTM	Notices to mariners
NWBM	Non-water based muds
NWMR	North-west Marine Region
NWS	North West Shelf
OCNS	Offshore Chemical Notification Scheme
OIM	Offshore Installation Manager
OIW	Oil in water
OOC	Oil on cuttings
OPEP	Oil Pollution Emergency Plan
OPGGS	Commonwealth *Offshore Petroleum and Greenhouse Gas Storage Act 2006*
OSPAR	Oslo–Paris Convention for the Protection of the Marine Environment of the North East Atlantic
OSREC	Oil Spill Response Enhancement Course
OVID	Off-shore Vessel Inspection Database
OVMSA	Offshore Vessel Safety Management System Assessment
PAH	Polycyclic aromatic hydrocarbon
PENV	Pendoley Environmental
PFW	Produced Formation Water
PGB	Permanent Guide Base
PO	Performance Outcome
PJ	Professional Judgement
PLF	Pilbara Line Fishery
PLONOR	Pose little or no risk to the environment
PMST	Protected Matters Search Tool
ppb	Parts per billion
ppm	Parts per million
PS	Performance Standard
PSRA	Process Safety Risk Assessment Procedure
PTS	Permanent threshold shift
PTW	Permit to Work

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Acronym	**Description**
RBA	Risk-based Analysis
RCC	Rescue Coordination Centre
rms	Root Mean Square
ROV	Remotely operated vehicle
SCE	Solids Control Equipment
SCSSV	Surface controlled subsurface safety valve
SEL	Sound Exposure Level
SFRT	Subsea First Response Toolkit
SIMAP	Spill Impact Mapping and Analysis program
SIMOPS	Simultaneous Operations
SMPEP	Spill Monitoring Program Execution Plan
SOPEP	Ship Oil Pollution Emergency Plan
SPL	Sound Pressure Level
SQG	Sediment Quality Guideline
SSDI	Subsea Dispersant Injection
SSIV	Subsea Isolation Valve
SSPL	Subsea and Pipelines
SV	Societal Value
T	Tonne
TAP	Threat Action Plan
TEC	Threatened Ecological Community
TGB	Temporary Guide Base
TSS	Total suspended solids
TTS	Temporary threshold shift
TUTU	Topside umbilical termination unit
UK	United Kingdom
US	United States
USBL	Ultra-short baseline
VOC	Volatile Organic Compound
WA	Western Australia
WBM	Water based muds
WCBD	Well Control Bridging Document
WCC	Woodside Communication Centre
WEL	Woodside Energy Limited
WHD	Wellhead
WHP	World Heritage Place
WMP	Waste Management Plan

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Acronym	Description
WMS	Woodside Management System
WOMP	Well Operations Management Plan
WPT	Wheatstone Platform

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APPENDIX A WOODSIDE HEALTH, SAFETY, ENVIRONMENT AND QUALITY AND RISK MANAGEMENT POLICIES

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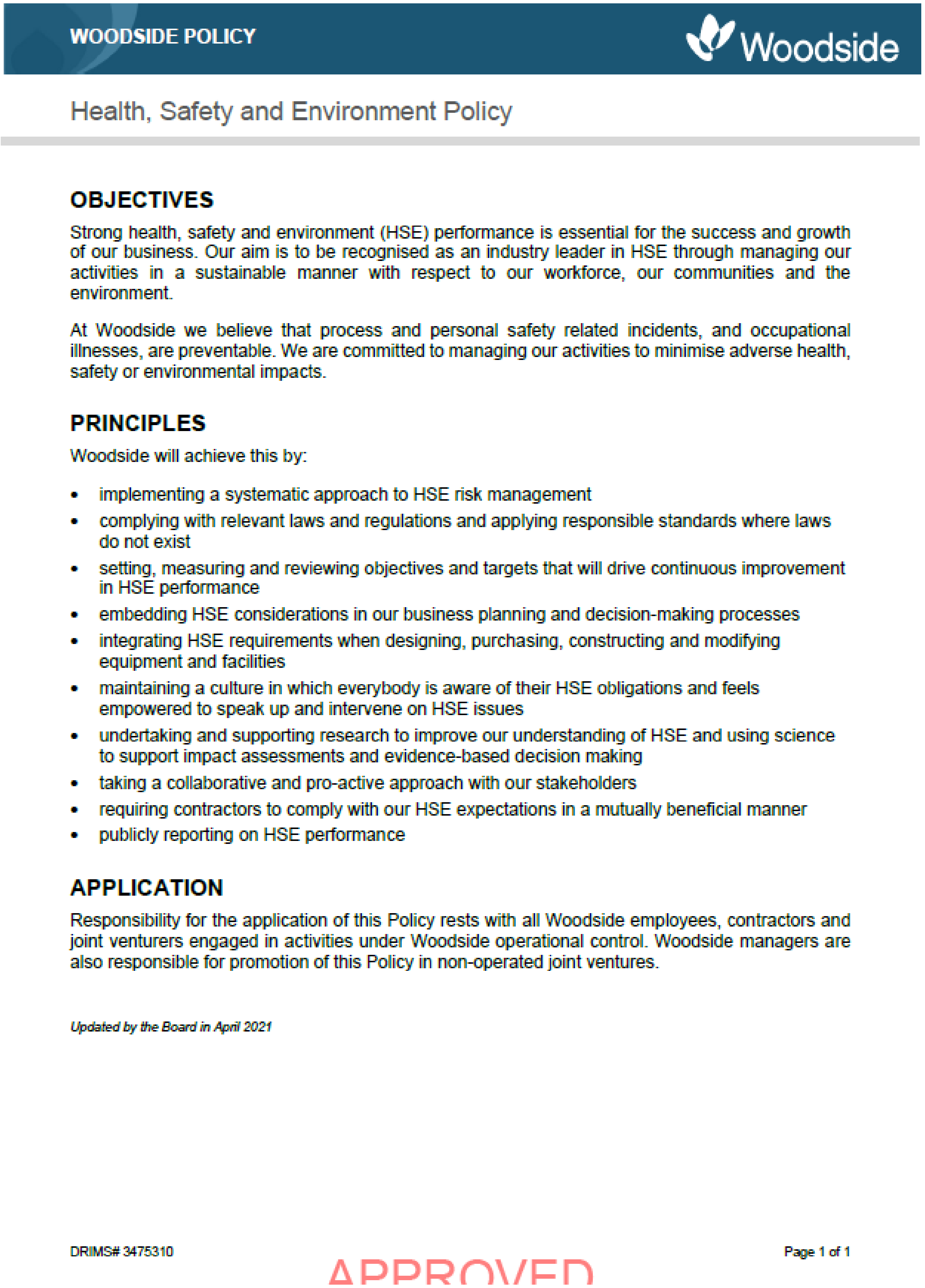

WOODSIDE POLICY

Woodside

Health, Safety and Environment Policy

OBJECTIVES

Strong health, safety and environment (HSE) performance is essential for the success and growth of our business. Our aim is to be recognised as an industry leader in HSE 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.

PRINCIPLES

Woodside will achieve this by:

- implementing a systematic approach to HSE 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 HSE performance
- embedding HSE considerations in our business planning and decision-making processes
- integrating HSE requirements when designing, purchasing, constructing and modifying equipment and facilities
- maintaining a culture in which everybody is aware of their HSE obligations and feels empowered to speak up and intervene on HSE issues
- undertaking and supporting research to improve our understanding of HSE 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 HSE expectations in a mutually beneficial manner
- publicly reporting on HSE 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.

Updated by the Board in April 2021

DRIMS# 3475310

Page 1 of 1

APPROVED

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WOODSIDE POLICY Woodside

Risk Management Policy

OBJECTIVES

Woodside recognises that risk is inherent in our business and the effective management of risk is vital to deliver our strategic objectives, continued growth and success. We are committed to managing risks in a proactive and effective manner as a source of competitive advantage.

Our approach protects us against potential negative impacts, enables us to take risk for reward and improves our resilience against emerging risks. The objective of our risk management framework is to provide a single consolidated view of risks across the company to understand our full risk exposure and prioritise risk management and governance.

The success of our approach lies in the responsibility placed on everyone at all levels to proactively identify, assess and treat risks relating to the objectives they are accountable for delivering.

PRINCIPLES

Woodside achieves these objectives by:

- Applying a structured and comprehensive framework for the identification, assessment and treatment of current risks and response to emerging risks;
- Ensuring line of sight of financial and non-financial risks at appropriate levels of the organisation;
- Demonstrating leadership and commitment to integrating risk management into our business activities and governance practices;
- Recognising the value of stakeholder engagement, best available information and proactive identification of potential changes in external and internal context;
- Embedding risk management into our critical business processes and control framework;
- Understanding our exposure to risk and tolerance for uncertainty to inform our decision making and assure that Woodside is operating with due regard to the risk appetite endorsed by the Board; and
- Evaluating and improving the effectiveness and efficiency our approach.

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 4 December 2020.

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APPENDIX B RELEVANT REQUIREMENTS

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The below table refers to Commonwealth Legislation related to the project.

Commonwealth Legislation	Legislation Summary
Air Navigation Act 1920 - *Air Navigation Regulations 1947* - *Air Navigation (Aerodrome Flight Corridors) Regulations 1994* - *Air Navigation (Aircraft Engine Emissions) Regulations 1995* - *Air Navigation (Aircraft Noise) Regulations 1984* - *Air Navigation (Fuel Spillage) Regulations 1999*	This Act relates to the management of air navigation.
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.
Australian Radiation Protection and Nuclear Safety Act 1998	This Act relates to the protection of the health and safety of people, and the protection of the environment from the harmful effects of radiation.
Biosecurity Act 2015 - *Quarantine Regulations 2000* - *Biosecurity Regulation 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.

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Commonwealth Legislation	Legislation Summary
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.
Navigation Act 2012 • *Marine order 12 – Construction – subdivision and stability, machinery and electrical installations* • *Marine order 30 - Prevention of collisions* • *Marine order 47 – Offshore Industry units* • *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 regulates navigation and shipping including Safety of Life at Sea (SOLAS). The Act will apply to some activities of the MODU and project vessels. 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.
Ozone Protection and Synthetic Greenhouse Gas Management Act 1989 • *Ozone Protection and Synthetic Greenhouse Gas Management Regulations 1995*	This Act provides for measures to protect ozone in the atmosphere by controlling and ultimately reducing the manufacture, import and export of ozone depleting substances (ODS) and synthetic greenhouse gases, and replacing them with suitable alternatives. The Act will only apply to Woodside if it manufactures, imports or exports ozone depleting substances.

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Commonwealth Legislation	Legislation Summary
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* *Maritime Legislation Amendment (Prevention of Air Pollution from Ships) Act 2007* MARPOL Convention	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—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.

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APPENDIX C EPBC ACT PROTECTED MATTERS SEARCH REPORTS

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Australian Government

Department of Agriculture,
Water and the Environment

EPBC Act Protected Matters Report

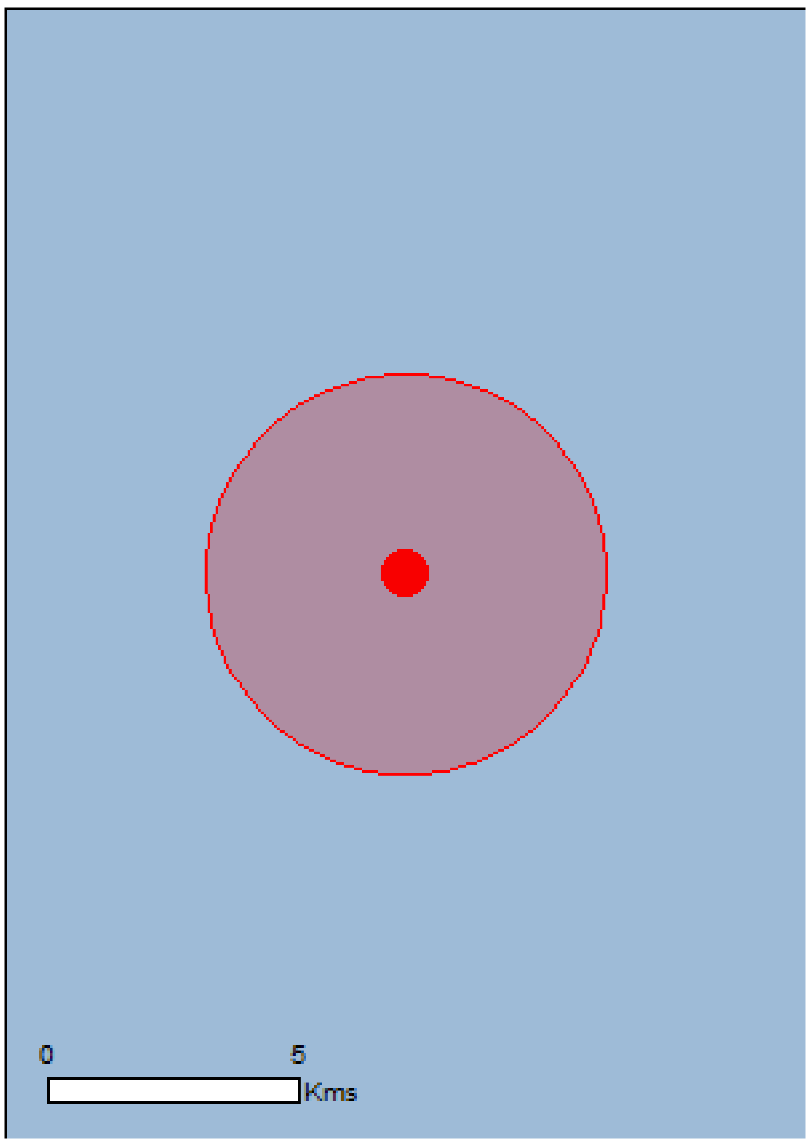
This report provides general guidance on matters of national environmental significance and other matters protected by the EPBC Act in the area you have selected.

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: 13/03/21 16:05:12

- Summary
- Details
  - Matters of NES
  - Other Matters Protected by the EPBC Act
  - Extra Information
- Caveat
- Acknowledgements



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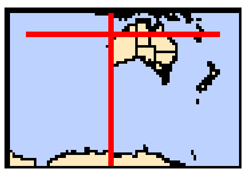
Coordinates

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:	19
Listed Migratory Species:	34

Other Matters Protected by the EPBC Act

This part of the report summarises other matters protected under the Act that may relate to the area you nominated. Approval may be required for a proposed activity that significantly affects the environment on Commonwealth land, when the action is outside the Commonwealth land, or the environment anywhere when the action is taken on Commonwealth land. Approval may also be required for the Commonwealth or Commonwealth agencies proposing to take an action that is likely to have a significant impact on the environment anywhere.

The EPBC Act protects the environment on Commonwealth land, the environment from the actions taken on Commonwealth land, and the environment from actions taken by Commonwealth agencies. As heritage values of a place are part of the 'environment', these aspects of the EPBC Act protect the Commonwealth Heritage values of a Commonwealth Heritage place. Information on the new heritage laws can be found at 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	Species or species habitat likely 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

Name	Status	Type of Presence
		habitat known to occur within area
Reptiles		
Caretta caretta		
Loggerhead Turtle [1763]	Endangered	Species or species habitat known to occur within area
Chelonia mydas		
Green Turtle [1765]	Vulnerable	Species or species habitat known to occur within area
Dermochelys coriacea		
Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Species or species habitat likely to occur within area
Eretmochelys imbricata		
Hawksbill Turtle [1766]	Vulnerable	Species or species habitat known to occur within area
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 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
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

Name	Threatened	Type of Presence
		habitat likely to occur within area
Balaenoptera edeni Bryde's Whale [35]		Species or species habitat may occur within area
Balaenoptera musculus Blue Whale [36]	Endangered	Species or species habitat likely to occur within area
Balaenoptera physalus Fin Whale [37]	Vulnerable	Species or species habitat likely to occur within area
Carcharhinus longimanus Oceanic Whitetip Shark [84108]		Species or species habitat 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 likely 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
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

Name	Threatened	Type of Presence
		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		
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

Name	Threatened	Type of Presence
		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
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

Name	Threatened	Type of Presence
		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
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

Name	Threatened	Type of Presence
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
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 known to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Species or species habitat known to occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Species or species habitat likely to occur within area
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 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 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
Balaenoptera edeni Bryde's Whale [35]		Species or species habitat may occur within area
Balaenoptera musculus Blue Whale [36]	Endangered	Species or species habitat likely to occur within area
Balaenoptera physalus Fin Whale [37]	Vulnerable	Species or species habitat likely to occur within area
Delphinus delphis Common 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

Name	Status	Type of Presence
		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 (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
Ancient coastline at 125 m depth contour	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

-20.0701 115.1835

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 Agriculture,
Water and the Environment

EPBC Act Protected Matters Report

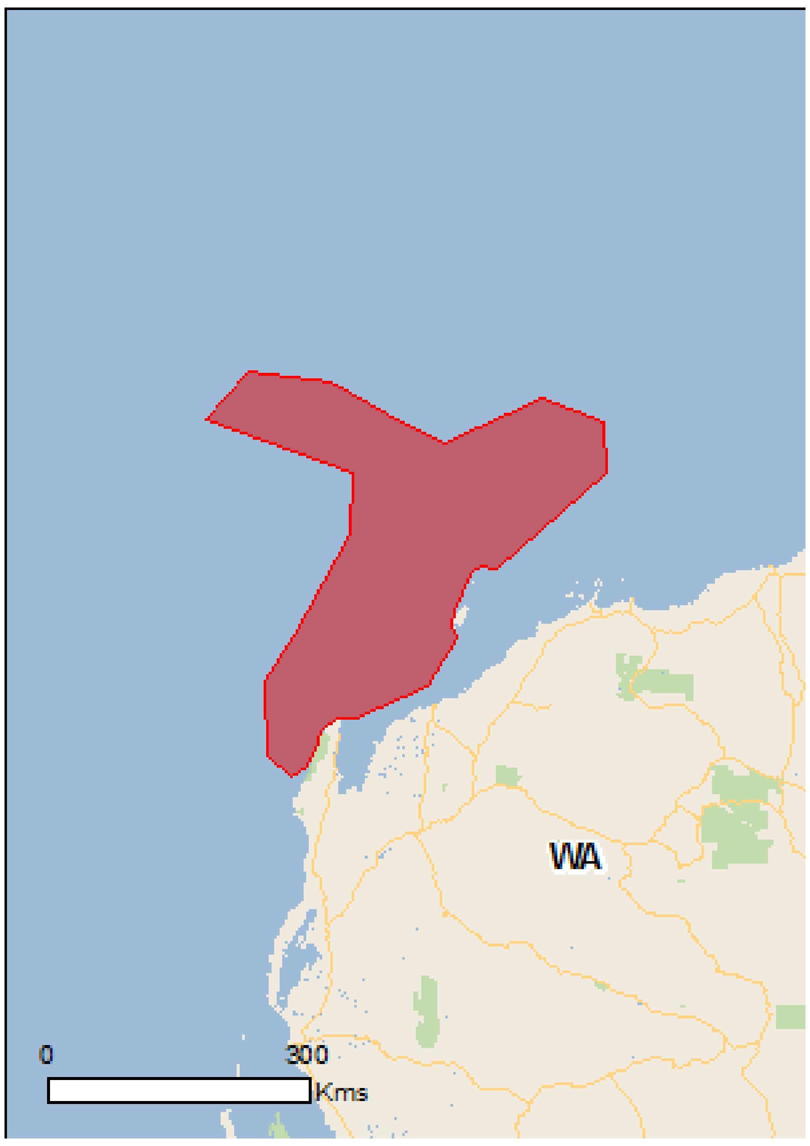
This report provides general guidance on matters of national environmental significance and other matters protected by the EPBC Act in the area you have selected.

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: 13/03/21 15:59:27

- Summary
- Details
  - Matters of NES
  - Other Matters Protected by the EPBC Act
  - Extra Information
- Caveat
- Acknowledgements



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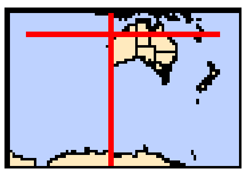
Coordinates

Buffer: 0.0Km



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:	1
National Heritage Places:	1
Wetlands of International Importance:	None
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	1
Listed Threatened Ecological Communities:	None
Listed Threatened Species:	29
Listed Migratory Species:	53

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:	1
Listed Marine Species:	92
Whales and Other Cetaceans:	29
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Australian Marine Parks:	3

Extra Information

This part of the report provides information that may also be relevant to the area you have nominated.

State and Territory Reserves:	5
Regional Forest Agreements:	None
Invasive Species:	1
Nationally Important Wetlands:	None
Key Ecological Features (Marine)	6

Details

Matters of National Environmental Significance

World Heritage Properties [Resource Information]

Name	State	Status
The Ningaloo Coast	WA	Declared property

National Heritage Properties [Resource Information]

Name	State	Status
Natural		
The Ningaloo Coast	WA	Listed place

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 known to occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat known to occur within area
Limosa lapponica menzbieri Northern Siberian Bar-tailed Godwit, Bar-tailed Godwit (menzbieri) [86432]	Critically Endangered	Species or species habitat known to 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 known to occur within area
Pezoporus occidentalis Night Parrot [59350]	Endangered	Species or species habitat may occur within area
Pterodroma mollis Soft-plumaged Petrel [1036]	Vulnerable	Species or species habitat may occur within area

Name	Status	Type of Presence
Rostratula australis Australian Painted Snipe [77037]	Endangered	Species or species habitat may occur within area
Sternula nereis nereis Australian Fairy Tern [82950]	Vulnerable	Breeding known to occur within area
Thalassarche impavida Campbell Albatross, Campbell Black-browed Albatross [64459]	Vulnerable	Species or species habitat may occur within area
Fish		
Milyeringa veritas Blind Gudgeon [66676]	Vulnerable	Species or species habitat may 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 to occur within area
Bettongia lesueur Barrow and Boodie Islands subspecies Boodie, Burrowing Bettong (Barrow and Boodie Islands) [88021]	Vulnerable	Species or species habitat known to occur within area
Eubalaena australis Southern Right Whale [40]	Endangered	Species or species habitat likely to occur within area
Isoodon auratus barrowensis Golden Bandicoot (Barrow Island) [66666]	Vulnerable	Species or species habitat known to occur within area
Megaptera novaeangliae Humpback Whale [38]	Vulnerable	Breeding known to occur within area
Reptiles		
Aipysurus apraefrontalis Short-nosed Seasnake [1115]	Critically Endangered	Species or species habitat known to occur within area
Caretta caretta Loggerhead Turtle [1763]	Endangered	Foraging, feeding or related behaviour known to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Breeding known to occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Species or species habitat known to occur within area
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	Breeding known to occur within area
Natator depressus Flatback Turtle [59257]	Vulnerable	Breeding 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

Name	Status	Type of Presence
		habitat known to 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 likely to occur within area
Apus pacificus		
Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Ardenna carneipes		
Flesh-footed Shearwater, Fleshy-footed Shearwater [82404]		Species or species habitat likely to occur within area
Ardenna pacifica		
Wedge-tailed Shearwater [84292]		Breeding known to occur within area
Calonectris leucomelas		
Streaked Shearwater [1077]		Species or species habitat 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
Hydroprogne caspia		
Caspian Tern [808]		Breeding known to occur within area
Macronectes giganteus		
Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Species or species habitat may occur within area
Sterna dougallii		
Roseate Tern [817]		Breeding likely to occur within area
Thalassarche impavida		
Campbell Albatross, Campbell Black-browed Albatross [64459]	Vulnerable	Species or species habitat may occur within area
Migratory Marine Species		
Anoxypristis cuspidata		
Narrow Sawfish, Knifetooth Sawfish [68448]		Species or species habitat known to occur within area
Balaena glacialis australis		
Southern Right Whale [75529]	Endangered*	Species or species habitat likely to occur within area
Balaenoptera bonaerensis		
Antarctic Minke Whale, Dark-shoulder Minke Whale [67812]		Species or species habitat likely to occur

Name	Threatened	Type of Presence
		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
Carcharhinus longimanus Oceanic Whitetip Shark [84108]		Species or species habitat likely to occur within area
Carcharodon carcharias White Shark, Great White Shark [64470]	Vulnerable	Species or species habitat known to occur within area
Caretta caretta Loggerhead Turtle [1763]	Endangered	Foraging, feeding or related behaviour known to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Breeding known to occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Species or species habitat known to occur within area
Dugong dugon Dugong [28]		Breeding known to occur within area
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	Breeding known to occur within area
Isurus oxyrinchus Shortfin Mako, Mako Shark [79073]		Species or species habitat likely to occur within area
Isurus paucus Longfin Mako [82947]		Species or species habitat likely to occur within area
Manta alfredi Reef Manta Ray, Coastal Manta Ray, Inshore Manta Ray, Prince Alfred's Ray, Resident Manta Ray [84994]		Species or species habitat known to 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 known to occur within area
Megaptera novaeangliae Humpback Whale [38]	Vulnerable	Breeding known to occur within area
Natator depressus Flatback Turtle [59257]	Vulnerable	Breeding known to occur within area
Orcinus orca Killer Whale, Orca [46]		Species or species habitat may occur within area
Physeter macrocephalus Sperm Whale [59]		Species or species habitat may occur within area
Pristis clavata Dwarf Sawfish, Queensland Sawfish [68447]	Vulnerable	Species or species

Name	Threatened	Type of Presence
		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 known to occur within area
Tursiops aduncus (Arafura/Timor Sea populations) Spotted Bottlenose Dolphin (Arafura/Timor Sea populations) [78900]		Species or species habitat known to occur within area
Migratory Terrestrial Species		
Hirundo rustica Barn Swallow [662]		Species or species habitat may occur within area
Motacilla cinerea Grey Wagtail [642]		Species or species habitat may occur within area
Motacilla flava Yellow Wagtail [644]		Species or species habitat may occur within area
Migratory Wetlands Species		
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat known to occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat known to occur within area
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat known to occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat known to occur within area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat may occur within area
Charadrius veredus Oriental Plover, Oriental Dotterel [882]		Species or species habitat may occur within area
Glareola maldivarum Oriental Pratincole [840]		Species or species habitat may occur within area
Limosa lapponica Bar-tailed Godwit [844]		Species or species habitat known to occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat known to occur within area
Pandion haliaetus Osprey [952]		Breeding known to occur within area
Thalasseus bergii Crested Tern [83000]		Breeding known to occur

Name	Threatened	Type of Presence
		within area
Tringa nebularia Common Greenshank, Greenshank [832]		Species or species habitat likely to occur within area

Other Matters Protected by the EPBC Act

Commonwealth Heritage Places

[Resource Information]

Name	State	Status
Natural		
Ningaloo Marine Area - Commonwealth Waters	WA	Listed place

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 known to occur within area
Anous stolidus Common Noddy [825]		Species or species habitat likely to occur within area
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Ardea alba Great Egret, White Egret [59541]		Species or species habitat known to occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat known to occur within area
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat known to occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat known to occur within area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat may occur within area
Calonectris leucomelas Streaked Shearwater [1077]		Species or species habitat likely to occur within area
Charadrius veredus Oriental Plover, Oriental Dotterel [882]		Species or species

Name	Threatened	Type of Presence
		habitat may 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
Glareola maldivarum Oriental Pratincole [840]		Species or species habitat may occur within area
Haliaeetus leucogaster White-bellied Sea-Eagle [943]		Species or species habitat likely to occur within area
Hirundo rustica Barn Swallow [662]		Species or species habitat may occur within area
Larus novaehollandiae Silver Gull [810]		Breeding known to occur within area
Limosa lapponica Bar-tailed Godwit [844]		Species or species habitat known to occur within area
Macronectes giganteus Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Species or species habitat may occur within area
Motacilla cinerea Grey Wagtail [642]		Species or species habitat may occur within area
Motacilla flava Yellow Wagtail [644]		Species or species habitat may occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat known to occur within area
Pandion haliaetus Osprey [952]		Breeding 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 likely to occur within area
Puffinus pacificus Wedge-tailed Shearwater [1027]		Breeding known to occur within area
Rostratula benghalensis (sensu lato) Painted Snipe [889]	Endangered*	Species or species habitat may occur within area
Sterna bengalensis Lesser Crested Tern [815]		Breeding known to occur within area
Sterna bergii Crested Tern [816]		Breeding known to occur within area
Sterna caspia Caspian Tern [59467]		Breeding known to occur within area

Name	Threatened	Type of Presence
Sterna dougallii Roseate Tern [817]		Breeding likely to occur within area
Sterna fuscata Sooty Tern [794]		Breeding known to occur within area
Sterna nereis Fairy Tern [796]		Breeding known to occur within area
Thalassarche impavida Campbell Albatross, Campbell Black-browed Albatross [64459]	Vulnerable	Species or species habitat may occur within area
Tringa nebularia Common Greenshank, Greenshank [832]		Species or species habitat likely to 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
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

Name	Threatened	Type of Presence
		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
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

Name	Threatened	Type of Presence
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
Mammals		
Dugong dugon Dugong [28]		Breeding known to 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 known to occur within area
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	Foraging, feeding or related behaviour known to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Breeding known to occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	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

Name	Threatened	Type of Presence
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	Breeding known to occur within area
Hydrelaps darwiniensis Black-ringed Seasnake [1100]		Species or species habitat may 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	Breeding 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 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 likely to 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

Name	Status	Type of Presence
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	Breeding known to occur within area
Mesoplodon densirostris Blainville's Beaked Whale, Dense-beaked Whale [74]		Species or species habitat may occur within area
Orcinus orca Killer Whale, Orca [46]		Species or species habitat may occur within area
Peponocephala electra Melon-headed Whale [47]		Species or species habitat may occur within area
Physeter macrocephalus Sperm Whale [59]		Species or species habitat may occur within area
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 known to occur within area
Stenella attenuata Spotted Dolphin, Pantropical Spotted Dolphin [51]		Species or species habitat may occur within area
Stenella coeruleoalba Striped Dolphin, Euphrosyne Dolphin [52]		Species or species habitat may occur within area
Stenella longirostris Long-snouted Spinner Dolphin [29]		Species or species habitat may occur within area
Steno bredanensis Rough-toothed Dolphin [30]		Species or species habitat may occur within area
Tursiops aduncus Indian Ocean Bottlenose Dolphin, Spotted Bottlenose Dolphin [68418]		Species or species habitat likely to occur within area
Tursiops aduncus (Arafura/Timor Sea populations) Spotted Bottlenose Dolphin (Arafura/Timor Sea populations) [78900]		Species or species habitat known to occur within area
Tursiops truncatus s. str. Bottlenose Dolphin [68417]		Species or species habitat may occur within area
Ziphius cavirostris Cuvier's Beaked Whale, Goose-beaked Whale [56]		Species or species

Name	Status	Type of Presence
		habitat may occur within area

Australian Marine Parks [Resource Information]

Name	Label
Gascoyne	Multiple Use Zone (IUCN VI)
Montebello	Multiple Use Zone (IUCN VI)
Ningaloo	Recreational Use Zone (IUCN IV)

Extra Information

State and Territory Reserves [Resource Information]

Name	State
Bessieres Island	WA
Boodie, Double Middle Islands	WA
Muiron Islands	WA
Serrurier Island	WA
Unnamed WA44665	WA

Invasive Species [Resource Information]

Weeds reported here are the 20 species of national significance (WoNS), along with other introduced plants that are considered by the States and Territories to pose a particularly significant threat to biodiversity. The following feral animals are reported: Goat, Red Fox, Cat, Rabbit, Pig, Water Buffalo and Cane Toad. Maps from Landscape Health Project, National Land and Water Resouces Audit, 2001.

Name	Status	Type of Presence
Mammals		
Mus musculus House Mouse [120]		Species or species habitat likely to occur within area

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
Commonwealth waters adjacent to Ningaloo Reef	North-west
Continental Slope Demersal Fish Communities	North-west
Exmouth Plateau	North-west
Glomar Shoals	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

-18.8989 116.8734,-18.6624 116.2263,-19.12 115.1985,-18.5049 114.0528,-18.4118 113.2041,-18.874 112.7525,-19.3842 114.2586,-19.9799 114.2489,-20.9639 113.6608,-21.4083 113.3662,-22.1225 113.3776,-22.3267 113.6357,-22.2256 113.8073,-22.0155 113.9026,-21.9048 113.9507,-21.7834 114.1003,-21.7709 114.3041,-21.4743 115.0339,-20.9944 115.3571,-20.8649 115.2926,-20.7397 115.3146,-20.3721 115.4925,-20.3075 115.5856,-20.3186 115.7646,-19.3886 116.8958,-18.8989 116.8734

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 STRATEGY SELECTION AND EVALUATION

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Balnaves Plug and Abandonment Oil Spill Preparedness and Response Mitigation Assessment

Security and Emergency Management
Hydrocarbon Spill Preparedness

September 2021
Revision 0a

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EXECUTIVE SUMMARY

Woodside Energy Julimar Pty Ltd (Woodside) has developed its oil spill preparedness and response position for the Balnaves Plug and Abandonment (P&A), 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	**01. Hydrocarbon release caused by loss of well containment** Release of 14,113 m^3 of Balnaves crude over 67 days (surface release of approximately 370 m^3 per day for 5 days and seabed release of 12,262 m^3 over 62 days) 8.4% residual component – 1,186 m^3	**Section 2.2**
	05. Hydrocarbon release caused by vessel collision Instantaneous release of 550 m^3 marine diesel 5% residual component – 27.5 m^3	
Hydrocarbon Properties	**01. Balnaves crude (API 48.8)** Balnaves Crude (API 22.5) is a mixture of volatile and persistent hydrocarbons with high proportions of volatile and semi-volatile components. In favourable evaporation conditions, about 47.7% of the oil mass should evaporate within the first 12 hours (BP < 180 °C); a further 20.7% should evaporate within the first 24 hours (180 °C < BP < 265 °C); and a further 23.2% should evaporate over several days (265 °C < BP < 380 °C). Approximately 8.4% of the oil is shown to be persistent. The residual compounds will tend to remain entrained beneath the surface under wind wave conditions, which will result in a higher percentage of biological and photochemical degradation. Given the proportion of entrained oil and the tendency for it to remain mixed in the water column, residual hydrocarbons will decay over time scales of several weeks. Soluble, aromatic, hydrocarbons contribute approximately 4.4% by mass of the whole oil. Around 2.8% by mass is highly soluble and highly volatile. A further 1.6% by mass has semi-to-low volatility. These compounds dissolve more slowly but tend to persist in soluble form for longer. Discharge onto the water surface will favour the process of evaporation over dissolution under calm sea conditions, but increased entrainment of oil and dissolution of soluble compounds can be expected under breaking wave conditions. **05. 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 between 12 hours and 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. Under calm conditions the majority of the remaining oil on the water surface will	**Section 6.7.1.1** of the EP Appendix A of the First Strike Plan

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<table>
<tr><td></td><td colspan="3">weather at a slower rate due to being comprised of the longer-chain compounds with higher boiling points. Evaporation of the residual compounds will slow significantly, and they will then be subject to more gradual decay through biological and photochemical processes.</td><td></td></tr>
<tr><td rowspan="5">Modelling Results</td><td colspan="3">A quantitative, stochastic assessment has been undertaken for credible spill scenarios to help assess the environmental risk of a hydrocarbon spill.
The stochastic modelling did not predict the threshold concentrations required to trigger deterministic modelling. Deterministic modelling was therefore not undertaken for either scenario and stochastic modelling has been used to scale the response.</td><td rowspan="5">Section 2.3</td></tr>
<tr><td></td><td>Credible Scenario-01 Loss of Well Containment</td><td>Credible Scenario-05 Marine diesel surface release</td></tr>
<tr><td>Minimum time to shoreline impact (above 100 g/m^2)</td><td>No contact at threshold</td><td>No contact at threshold</td></tr>
<tr><td>Largest volume ashore at any single Response Priority Area (RPA) (above 100 g/m^2)</td><td>No contact at threshold</td><td>No contact at threshold</td></tr>
<tr><td>Largest total shoreline accumulation (above 100 g/m^2) all shorelines</td><td>No contact at threshold</td><td>No contact at threshold</td></tr>
<tr><td>Net Environmental Benefit Analysis</td><td colspan="3">Monitor and evaluate, source control via vessel SOPEP, source control via well intervention, shoreline clean-up, oiled wildlife response, are all identified as potentially having a net environmental benefit (dependent on the actual spill scenario) and carried forward for further assessment.</td><td>Section 4</td></tr>
<tr><td>ALARP evaluation of selected response techniques</td><td colspan="3">The evaluation of the selected response techniques shows the proposed controls reduced the risk to an ALARP and Acceptable level for the risk presented in Section 2, without the implementation of considered additional, alternative or improved control measures.</td><td>Section 7</td></tr>
</table>

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1 INTRODUCTION

1.1 Overview

Woodside Energy Julimar Pty Ltd (Woodside) has developed its oil spill preparedness and response position for the Balnaves Plug and Abandonment (P&A), hereafter known as the Petroleum Activities Program (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 Balnaves Plug and Abandonment (P&A) Environment Plan (EP)
- Oil Pollution Emergency Arrangements (OPEA) (Australia)
- The Balnaves Plug and Abandonment Oil Pollution Emergency Plan (OPEP) including
    - First Strike Response Plan (FSP)
    - Relevant Operations Plans
    - Relevant Tactical Response Plans (TRPs)
    - Relevant Supporting Plans
    - Data Directory.

The purpose of this document is to demonstrate 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.

1.3 Scope

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 risks and impacts resulting from an unplanned loss of hydrocarbon containment associated with the PAP described in the 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. It should be read in conjunction with the documents listed in **Table 1-1**. The location of the Petroleum Activity Program 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.

The Oil Pollution First Strike Plan (FSP) 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 Oil Pollution FSP is underway. The IAP includes inputs from the Monitor and Evaluate (ME) operations and the operational NEBA (**Section 4**). Planning, coordination and resource management are initiated by the Incident

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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 (**Section 4**).

The response will continue as described in **Section 5** until the response termination criteria have been met.

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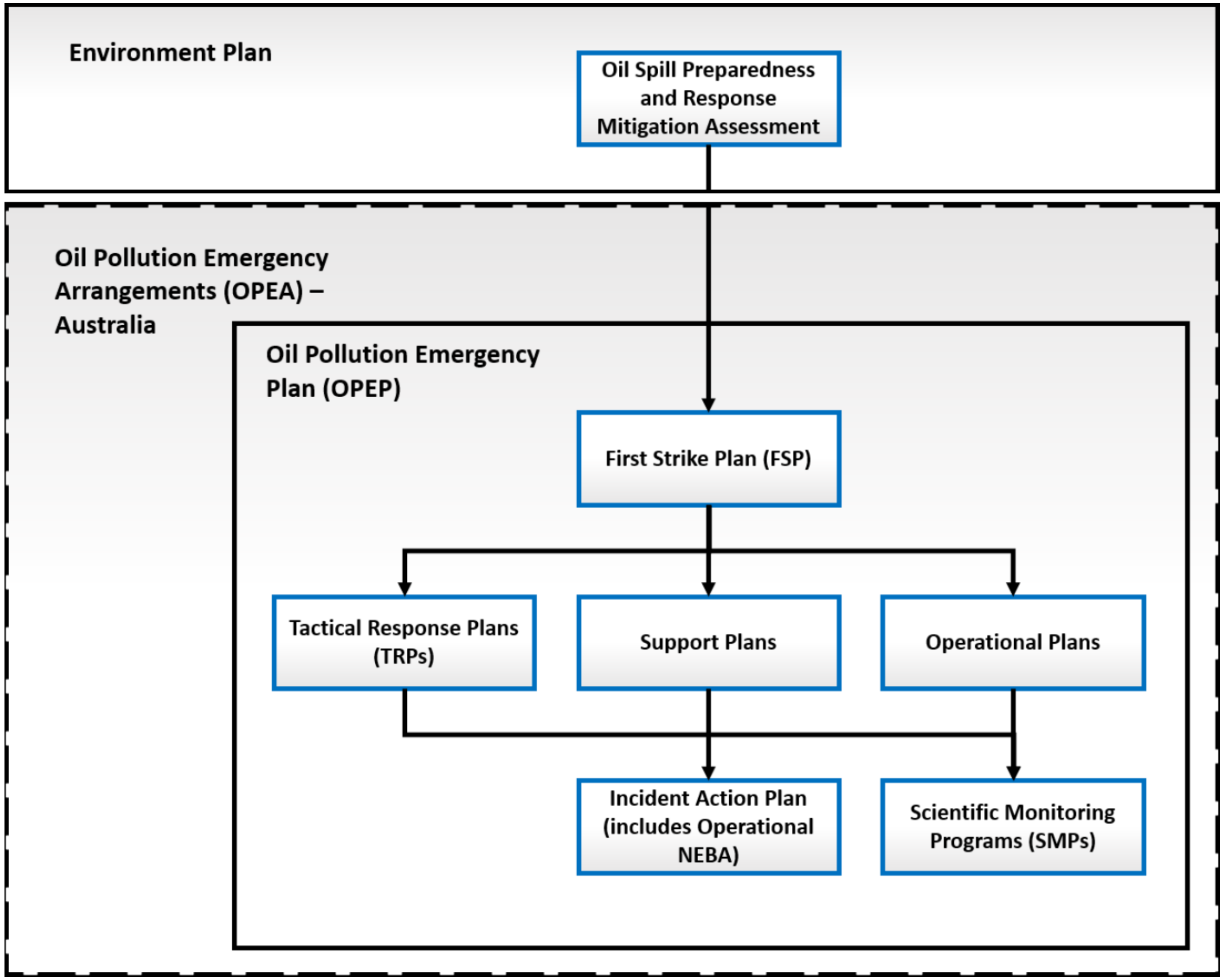

Figure 1-1: Woodside hydrocarbon spill document structure

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Table 1-1: Hydrocarbon Spill preparedness and response – document references

Document	Document overview	Stakeholders	Relevant information	Document name/reference
Balnaves P&A Environment Plan (EP)	Demonstrates that potential adverse impacts on the environment associated with the Balnaves P&A (during both routine and non-routine operations) are mitigated and managed to As Low As Reasonably Practicable (ALARP) and will be of an acceptable level.	NOPSEMA Woodside internal	EP Section 6 (Identification and evaluation of environmental risks and impacts, including credible spill scenarios) EP Section 7 (Implementation strategy – including emergency preparedness and response) EP Section 7.8 (Reporting and compliance) EP Section 6 (Performance outcomes, standards and measurement criteria)	
Oil Pollution Emergency Arrangements (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	
Oil Spill Preparedness and Response Mitigation Assessment for the Balnaves P&A EP (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.	
Balnaves P&A Oil Pollution First Strike Response Plan	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 Incident Action Plan (IAP) specific to the event is developed. Oil Pollution First Strike Response Plans are intended to be the first document used to provide immediate guidance to the responding Incident Management Team (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 modelling, aerial surveillance and oil spill tracking buoy details.	

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Document	Document overview	Stakeholders	Relevant information	Document name/reference
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 Activity Source Control Emergency Response Plan Vessel Shipboard Oil Pollution Emergency Plan (SOPEP) Shoreline Clean-up Oiled Wildlife Waste Management Scientific Monitoring
Tactical Response Plans	Provides options for response techniques in selected 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.	For full list of relevant Tactical Plans for the Balnaves P&A oil spill response, refer to ANNEX E: Tactical Response Plans.
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.	Technique 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)

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Document	Document overview	Stakeholders	Relevant information	Document name/reference
				Stakeholder Engagement Accommodation and Catering Waste Management Guidance for Oil Spill Claims Management Not Controlled (Land based) Security Support Plan Hydrocarbon Spill Responder Health Monitoring Guideline

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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 Balnaves P&A First Strike Plan (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.

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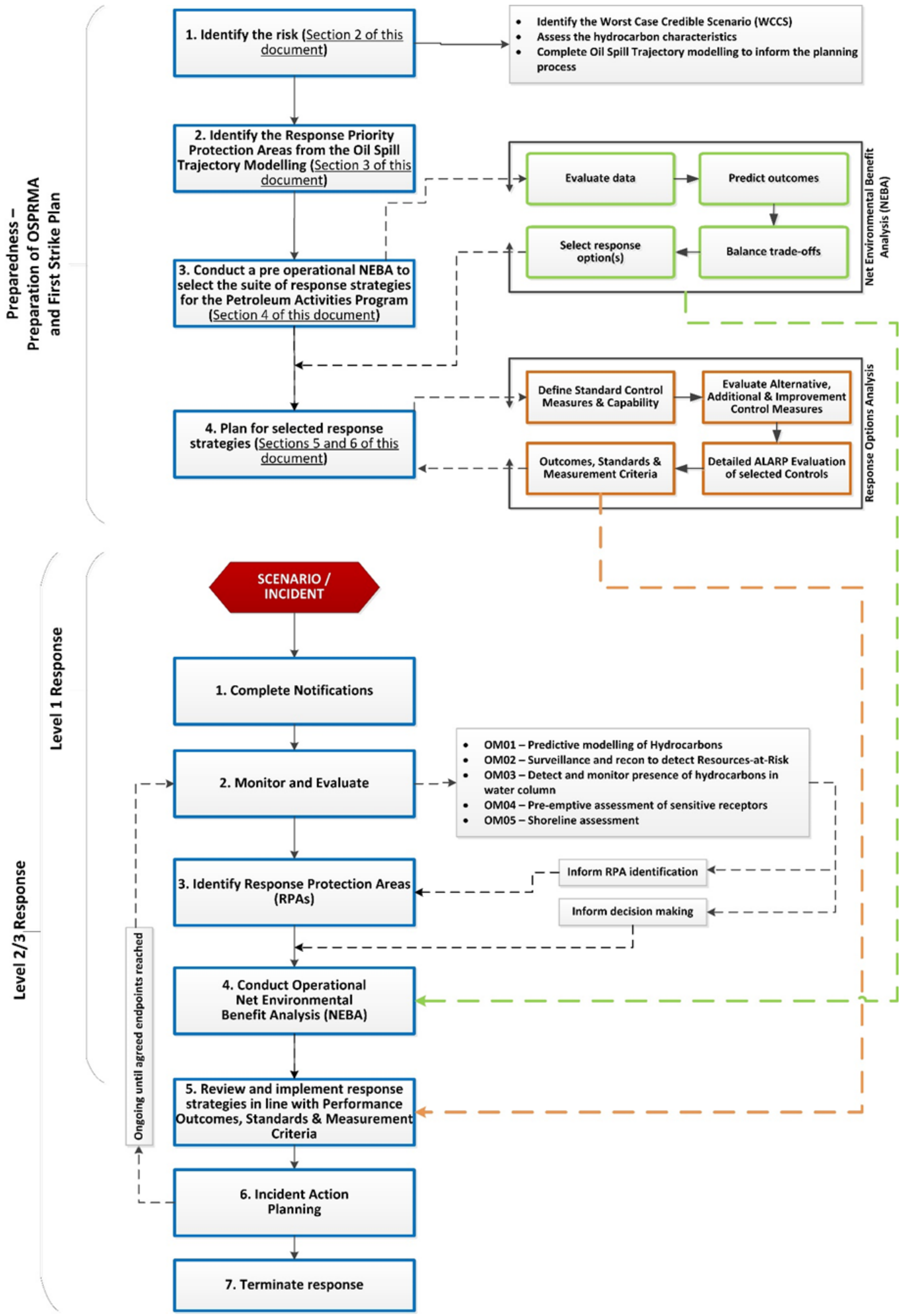

Figure 2-1: Response planning and selection process

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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 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

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2.1.1 Response Planning Assumptions

For the purpose of defining terms related to response planning and timing, the following definitions have been developed;

IMT Call-out/ Notification	Contract Activation	Response Option Mobilisation	Response Option Deployment	Response Option Effectiveness
This is the time taken from call-out to mobilise the IMT to the designated Incident Control Centre	**This is the time taken once the IMT has been mobilised to activate specific contracts for resources (SFRT, FWADC, AMOSC, AMSA, OSRL, etc)**	**This is the time taken to mobilise resources from home location to laydown/staging area (expected to be airport or sea port) close to response area**	**This is the time taken to deploy resources from laydown/staging area (expected to be airport or sea port) to response area/field**	**This relates to the performance of equipment/response option as well as required personnel resourcing (Specialists/Supervisors + support personnel)**
Approx 2-4 hours	**Approx 2-4 hours**	**Response Technique specific**	**Field/Location specific**	**Response Strategy specific**

Figure 2-2: Response Planning Assumption - Timing, Resourcing and Effectiveness

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2.2 Environment Plan Risk Assessment (Credible Spill Scenarios)

Potential hydrocarbon release scenarios from the PAP have been 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. Five unplanned events or credible spill scenarios for the PAP have been selected as representative across types, sources and incident/response levels, up to and including the WCCS.

Table 2-1 presents the credible scenarios for the PAP. The WCCS for the activity is then used for response planning purposes, as all other scenarios are of a lesser scale and extent. 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.

A 67-day surface/subsurface loss of well containment resulting in the release of Balnaves crude (Credible Scenario-01; CS-01) has been modelled to determine the WCCS for response planning purposes. Two other 67-day uncontrolled release scenarios, resulting from the accidental removal of a subsea Xmas tree (Credible Scenario-02 and Credible Scenario-03; CS-02 and CS-03), have also been considered credible. However, given that the total release volumes and the release rates for these scenarios are less than CS-01, they are considered to be within the risk profile and spill response capability requirements of CS-01.

The surface release of marine diesel caused by a marine vessel collision (Credible Scenario-05; CS-05) has also been modelled and considered for response planning purposes, given the large volume released over a short period of time and the different hydrocarbon properties, which warrant different spill response techniques. Credible Scenario-04 (CS-04) has a significantly smaller marine diesel release volume and is considered to be within the risk profile and spill response capability requirements of CS-05.

CS-01 and CS-05 are therefore selected for response planning purposes.

Table 2-1: Petroleum Activities Program credible spill scenarios

Credible Spill Scenarios	Scenario selected for planning purposes	Scenario description	Maximum credible volume released (liquid m^3)^1	Incident Level	Hydrocarbon (HC) type	Residual proportion	Residual volume (liquid m^3)
Credible Spill Scenario 01 (Worst Case)	Yes	67-day uncontrolled surface/subsurface loss of well containment during well abandonment: Surface: Approx. 370 m^3 per day for 5 days; then Seabed: 12,262 m^3 over 62 days	14,113 m^3	Level 3 (WCCS)	Balnaves crude	8.4%	17.7 m^3 per day (averaged over total 67-day duration) 1,185.5 m^3 total
Credible Spill Scenario - 02	No	Subsurface leak caused by accidental removal or failure of a Xmas tree during preservation period. 67-day uncontrolled subsea release of 390 m^3.	390 m^3	Level 2	Balnaves crude	8.4%	0.5 m^3 per day (averaged over total 67-day duration) 32.8 m^3 total
Credible Spill Scenario - 03	No	Subsurface leak caused by accidental removal or failure of a Xmas tress during well P&A. 67-day uncontrolled subsea release of 390 m^3.	390 m^3	Level 2	Balnaves crude	8.4%	0.5 m^3 per day (averaged over total 67-day duration) 32.8 m^3 total
Credible Spill Scenario - 04	No	Hydrocarbon release during bunkering caused by refueling hose failure, coupling failure or operator error.	8 m^3	Level 1	Marine diesel	5%	0.4 m^3 total
Credible Spill Scenario - 05	Yes	Hydrocarbon release caused by marine vessel collision. Instantaneous release of 550 m^3 of marine diesel within the Operational Area.	550 m^3	Level 2	Marine diesel	5%	27.5 m^3 total

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2.2.1 Hydrocarbon Characteristics

Hydrocarbon characteristics, including modelled weathering data and ecotoxicity, are included in Section 6 of the EP.

Balnaves Crude

Balnaves crude is a mixture of volatile and persistent hydrocarbons with high proportions of volatile and semi-volatile components. In favourable evaporation conditions, about 47.7% of the oil mass should evaporate within the first 12 hours (BP < 180 °C); a further 20.7% should evaporate within the first 24 hours (180 °C < BP < 265 °C); and a further 23.2% should evaporate over several days (265 °C < BP < 380 °C). Approximately 8.4% of the oil is shown to be persistent.

The whole oil has a low asphaltene content (~0.5%), indicating a low propensity for the mixture to take up water to form water-in-oil emulsion over the weathering cycle.

Soluble, aromatic, hydrocarbons contribute approximately 4.4% by mass of the whole oil. Around 2.8% by mass is highly soluble and highly volatile. A further 1.6% by mass has semi-to-low volatility. These compounds dissolve more slowly but tend to persist in soluble form for longer. Discharge onto the water surface will favour the process of evaporation over dissolution under calm sea conditions, but increased entrainment of oil and dissolution of soluble compounds can be expected under breaking wave conditions.

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 28 m^3 of product would remain after weathering from the representative marine diesel scenario.

2.3 Hydrocarbon Spill Modelling

Oil spill trajectory modelling 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 impact that was also used under the United States Oil Pollution Act 1990 Natural Resource Damage Assessment (NRDA)

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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 Natural Resource Damage Assessment (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 has been used as expert witness evidence in Australian court proceedings, aiding the prosecution to determine spill quantum estimates.

2.3.1 Stochastic Modelling

Stochastic modelling has been completed for Scenario-01 and Scenario-05, outlined in **Table 2-1**. A quantitative, stochastic assessment has been undertaken for credible spill scenarios to help assess the environmental consequences of a hydrocarbon spill.

Multiple replicate simulations were completed for each scenario to test for trends and variations in the trajectory and weathering of the spilled oil, with an even number of replicates completed using samples of metocean data that commenced within each calendar quarter. For Scenario-01, a total of 100 replicate simulations were run over an annual period (25 per quarter). For Scenario-05, a total of 200 replicate simulations were run over an annual period (50 per quarter). Further details relating to the assessments for the scenarios can be found in 6 of the EP.

2.3.1.1 Environmental Impact Thresholds – 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 Environment that May Be Affected (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.

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Table 2-2: Summary of thresholds applied to the stochastic hydrocarbon spill modelling to determine the EMBA and environmental impacts

Threshold (Balnaves crude)	Theshold (marine diesel)	Description
10 g / m^2	10 g/m^2	Surface hydrocarbon
100 ppb	500 ppb	Entrained hydrocarbon (ppb)
50 ppb	500 ppb	Dissolved aromatic hydrocarbon (ppb)
100 g / m^2	100 g/m^2	Shoreline accumulation

2.3.2 Deterministic Modelling

Deterministic modelling is undertaken where initial stochastic modelling has indicated that floating oil is present at an impact threshold of 50 g/m^2 and/or where there is shoreline accumulations at an impact threshold of 100 g/m^2. The deterministic modelling outputs are then used to scale the required capability for the offshore (containment and recovery and dispersant) and/or shoreline responses.

The selected stochastic modelling used as a representative of this PAP did not predict the threshold concentrations required to trigger the undertaking of deterministic modelling. Deterministic modelling was therefore not undertaken for either CS-01 or CS-05 and stochastic modelling has been used to scale the response.

2.3.3 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 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 spill modelling results are then used to assess the nature and scale of a response.

In the event of an actual response, existing modelling would be reviewed for suitability and additional modelling would be conducted using real-time data and field information to inform Incident Management Team decisions.

The spill modelling outputs are presented at response planning thresholds for surface hydrocarbons for the WCCS. Surface spill concentrations are expressed as grams per square metre (g/m^2) (**Section 2.2**). The thresholds used are derived from oil spill response planning literature and industry guidance and are summarised below.

2.3.4 Surface Hydrocarbon Concentrations

Table 2-3: Surface hydrocarbon thresholds for response planning

Surface hydrocarbon concentration (g/m^2)	Description	Bonn Agreement Oil Appearance Code (BAOAC)	Mass per area (g/m^2)
>10	Predicted minimum threshold for commencing operational monitoring [1]	Code 3 – Dull metallic colours	5 - 50

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[1] 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 Western Australia Department of Transport (WA DoT).

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Surface hydrocarbon concentration (g/m²)	Description	Bonn Agreement Oil Appearance Code (BAOAC)	Mass per area (g/m²)
50	Predicted minimum floating oil threshold for containment and recovery and surface dispersant application [2]	Code 4 – Discontinuous true oil colour	50 - 200
100	Predicted optimum floating oil threshold for containment and recovery and surface dispersant application	Code 5 – Continuous true oil colour	>200
Shoreline hydrocarbon concentration (g/m²)	**Description**	**National Plan Guidance on Oil Contaminated Foreshores**	**Mass per area (g/m²)**
100	Predicted minimum shoreline accumulation threshold for shoreline assessment operations	Stain	>100
250	Predicted minimum threshold for commencing shoreline clean-up operations	Level 3 - Thin Coating	200 - 1000

The surface thickness of oil at which dispersants are typically effective is approximately 100 g/m^2. 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/m^2) (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 AMSA (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 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).

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[2] At 50 g/m^2, 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.

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Guidance from the National Oceanic and Atmospheric Administration (NOAA) in the United States is found in the document: *Characteristics of Response Techniques: 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 50 g/m^2 was chosen as an average / equilibrium thickness (50 g/m^2 is an average is 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).

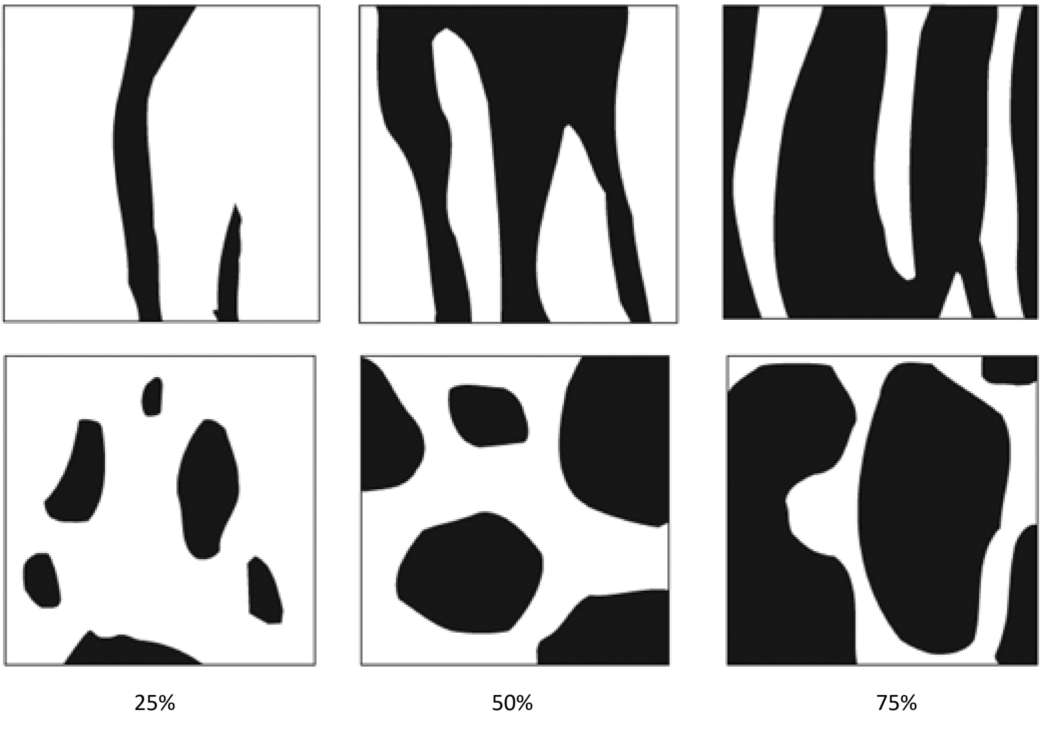

Figure 2-3: Proportion of total area coverage (AMSA, 2014)

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.

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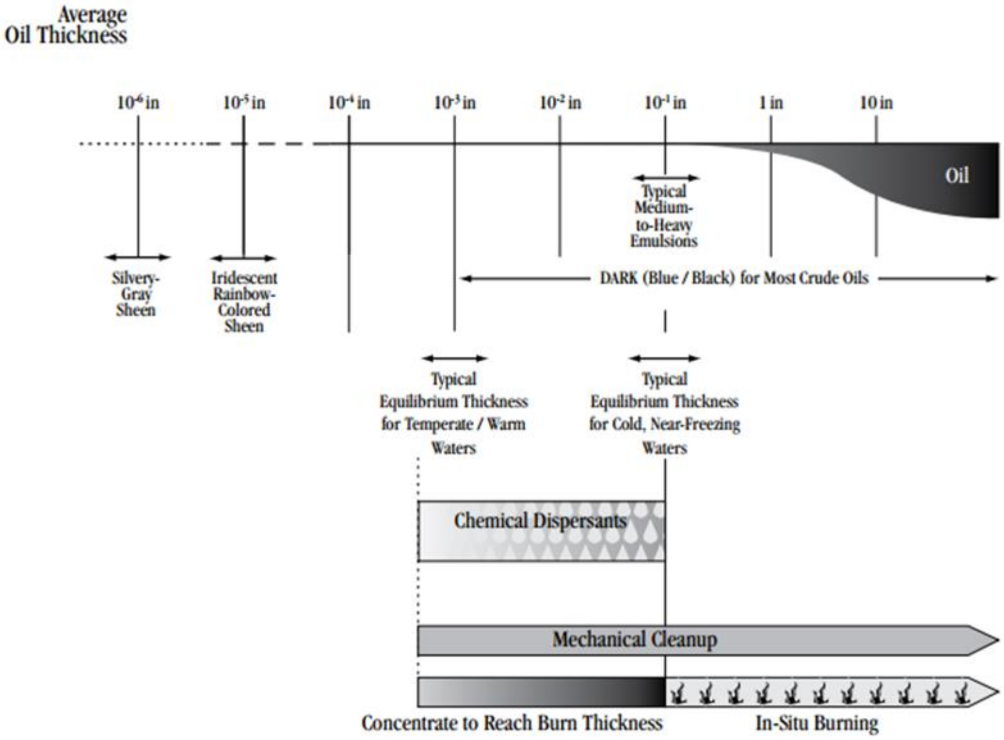

Figure 2-4: Oil thickness versus potential response options (from Allen and Dale 1996)

Wind and waves influence the feasibility of mechanical clean-up operations, dropping the effectiveness significantly because of entrainment and/or splash-over as short period waves develop beyond two to three feet (0.6–0.9m) in height. Waves and wind can also be limiting factors for the safe operation of vessels and aircraft.

2.3.5 Surface Hydrocarbon Viscosity

Table 2-4: Surface hydrocarbon viscosity thresholds

Surface viscosity (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	500-5000
10,000	Predicted maximum viscosity for effective surface dispersant operations	Sometimes possible to disperse	5,000-10,000

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.s (1,000 – 2,000 cSt) and then declining to a low level with an oil viscosity of 10,000 mPa.s (10,000 cSt). It was considered that some generally applicable viscosity limit, such as 2,000 or 5,000 mPa.s (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.s (5,000 cSt) or more, and their performance gradually decreases with increasing viscosity; oils with a

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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.

The thresholds described above are compared with the modelling results for the WCCS (**Table 2-5**).

2.3.6 Spill Modelling Results

Details of the scenario and selected stochastic modelling inputs are included along with modelling results in **Table 2-5**.

Table 2-5: Worst case credible scenario modelling results

Scenario description	Credible Scenario-01	Credible Scenario-05
Worst-case credible scenario(s) (WCCS) Total volume released	Hydrocarbon release caused by loss of well containment during well P&A. Release of 14,113 m^3 over 67-days (surface release of approximately 370 m^3 per day for 5 days and seabed release of 12,262 m^3 over 62 days)	Hydrocarbon release caused by vessel collision. Instantaneous release of 550 m^3.
Worst-case credible scenario(s) (WCCS) Residual volume remaining post-weathering	8.4% residual component – 1,185.5 m^3 Balnaves crude	5% residual component – 27.5 m^3 marine diesel

Analysis of the stochastic modelling results predicts the following:

2.3.6.1 Credible Scenario-01 (Loss of Well Containment, Balnaves Crude)

- Surface hydrocarbon concentrations of Balnaves crude will not meet the 50 g/m^2 minimum concentration required for surface dispersant application or containment and recovery operations to be effective.
- Surface hydrocarbons greater than 10 g/m^2 and 1 g/m^2 may travel up to a maximum of 11 km and 58 km from the release location, respectively.
- Surface hydrocarbons at concentrations equal to or greater than 1 g/m^2 are not predicted to contact any shoreline.
- Approximately, 8.4% of Balnaves Crude is persistent and will persist in the marine environment as a residual component. Over the 67-day duration of the release, this residual component represents approximately 1,186 m^3. However, surface hydrocarbon concentrations are predicted to weather and disperse rapidly. The modelling predicts that the residual compounds will tend to remain entrained beneath the surface, which will result in a higher rate of biological and photochemical degradation. Given the proportion of entrained oil and the tendency for it to remain mixed in the water column, the remaining hydrocarbons will decay over time scales of several weeks.
- Numerous islands, banks and shoals may be exposed to entrained hydrocarbons greater than 100 ppb within 14 days.

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- Shoreline accumulation greater than the 100 g/m^2 threshold is not predicted to occur at any location.
- Four shoreline locations exposed to entrained hydrocarbons greater than 100 ppb within 14 days are also predicted to accumulate low shoreline accumulations >10 g/m^2, due to the stranding of small volumes of entrained residual oil:
    - Barrow Island: (min. time to accumulation: 8 days; max. concentration: 27 g/m^2; max. total volume: 2 m^3)
    - Montebello Islands: (min. time to accumulation: 8 days; max. concentration: 44 g/m^2; max. total volume: 3 m^3)
    - Southern Pilbara Islands: (min. time to accumulation: 30 days; max. concentration: 17 g/m^2; max. total volume: <1 m^3)
    - Boodie, Double, Middle Islands Nature Reserve: (min. time to accumulation: 49 days; max. concentration: 15 g/m^2; max. total volume: <1 m^3)
- Other shoreline locations exposed to entrained hydrocarbons greater than 100 ppb over timescales longer than 14 days are also predicted to accumulate low shoreline accumulations >10 g/m^2, due to the stranding of small volumes of entrained residual oil:
    - Muiron Islands: (min. time to accumulation: 20 days; max. concentration: 49 g/m^2; maximum total volume: 2 m^3)
    - Ningaloo Coast (incl. WHA, State MP and Cape Range NP): (min. time to accumulation: 25 days; max. concentration: 51 g/m^2; maximum total volume: 6 m^3)
    - Peaky Island, Sunday Island and Thevenard Island, each with a shoreline accumulation time between 30 days and 72 days, max. concentrations of 15 – 17 g/m^2; and max. total volumes of <1 m^3

2.3.6.2 Credible Scenario-05 (Surface Release, Marine Diesel)

- Surface hydrocarbon concentrations of marine diesel for Scenario-05 will not meet the 50 g/m^2 minimum concentration required for surface dispersant application or containment and recovery operations to be effective.
- Surface hydrocarbon concentrations greater than 10 g/m^2 may travel up to a maximum of 85 km.
- Floating oil at concentrations equal to or greater than 1 g/m^2 are unlikely to contact any shoreline receptors.
- Shoreline accumulation greater than the 100 g/m^2 and 10 g/m^2 thresholds are not predicted to occur at any location.
- Entrained oil at concentrations equal to or greater than 100 ppb may occur at the Montebello AMP, Gascoyne AMP, Rankin Bank, and Ningaloo Coast Middle and North (including the Ningaloo WHA and AMP).

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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**.

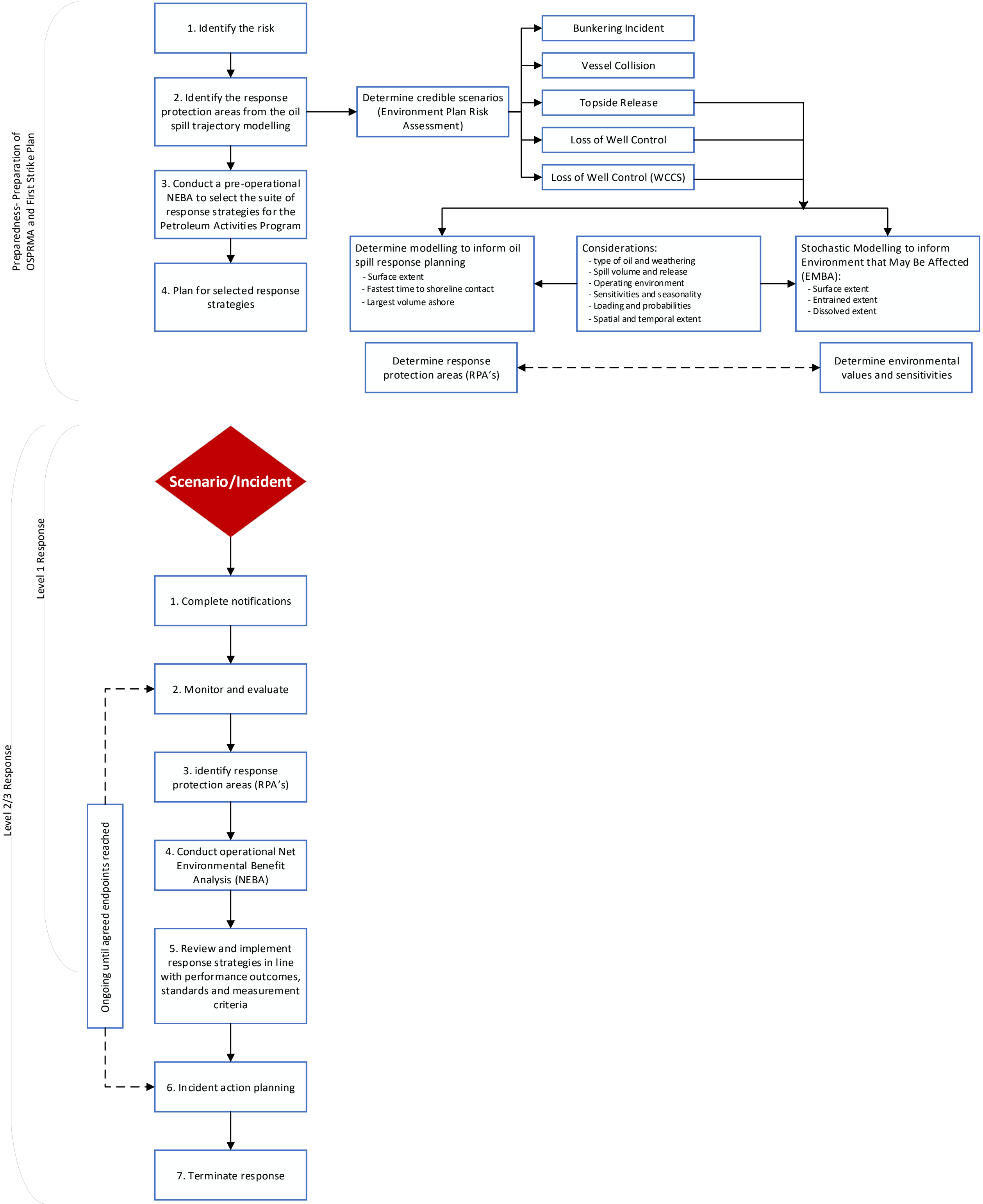

Figure 3-1: Identify Response Protection Areas (RPAs) flowchart

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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 of Conservation of Nature IUCN marine protected area categories
    - high conservation value habitat and species
    - important socio-economic/heritage value.

3.2 Identify Response Protection Areas

From the identified sensitive receptors described in Section 6 of the EP, only those which a shoreline response could feasibly be conducted (accumulation >100 g/m^2 for shoreline assessment and/or contact with surface slicks >10 g/m^2 for operational monitoring) have been selected for response planning purposes.

3.2.1 Response Protection Areas

RPAs have been selected on the basis of their environmental ecological, social, economic, cultural and heritage values and sensitivities and the ability to conduct a response based on the minimum response thresholds (**Section 2.3.3**).

Based on the stochastic modelling undertaken for this activity, contact from floating hydrocarbons >10 g/m^2 is predicted for Commonwealth waters only. Additionally, modelling shows there is no accumulation above 100 g/m^2 on any shoreline. Thus, deterministic modelling was not required for response scaling.

Although stochastic modelling showed no impact above thresholds, RPAs have been selected based on five shoreline locations predicted to receive lower shoreline accumulations greater than 10 g/m^2, and these have been considered for completing the NEBA and to support response planning (**Table** 3-1).

During a real spill event, however, operational monitoring techniques 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.

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Table 3-1: Response Protection Areas (RPAs) from stochastic modelling

Areas of coastline contacted	**Conservation status**	**IUCN protection category**	**Credible Scenario-01**		**Credible Scenario-05**	
			Minimum time to shoreline contact (above 100 g/m^2) in days [3]	**Maximum shoreline accumulation (above 100 g/m^2) in m^3** [4]	**Minimum time to shoreline contact (above 100 g/m^2) in days** [3]	**Maximum shoreline accumulation (above 100 g/m^2) in m^3** [4]
Muiron Islands State Marine Park	Muiron Islands Marine Management Area	IUCN VI - Multiple Use Zone	No contact at response threshold 20.1 days for contact at 10 g/m^2	No contact at response threshold 2 m^3 at 10 g/m^2	No shoreline contact above threshold predicted	No shoreline contact above threshold predicted
Montebello Islands	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 response threshold 8.3 days for contact at 10 g/m^2	No contact at response threshold 3 m^3 for 10 g/m^2	No shoreline contact above threshold predicted	No shoreline contact above threshold predicted
Barrow Island	Barrow Island Marine Park Barrow Island Marine Management Area Class A Nature Reserve	IUCN IA – Strict Nature Reserve IUCN VI – Multiple Use Zone IUCN IV – Recreational Use Zone	No contact at response threshold 8.3 days for contact at 10 g/m^2	No contact at response threshold 2 m^3 at 10 g/m^2	No shoreline contact above threshold predicted	No shoreline contact above threshold predicted
Southern Pilbara – Islands	Nature Reserve (not Class A)	Unknown	No contact at response threshold 30.5 days for contact at 10 g/m^2	No contact at response threshold <1 m^3 at 10 g/m^2	No shoreline contact above threshold predicted	No shoreline contact above threshold predicted

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[3] This volume and time represent the first time to contact on defined shoreline polygon and the maximum volume ashore for that 24 hour period.

[4] This volume and time represent the maximum volume ashore on defined shoreline polygon for any 24 hour time period

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Areas of coastline contacted	Conservation status	IUCN protection category	Credible Scenario-01		Credible Scenario-05	
			Minimum time to shoreline contact (above 100 g/m^2) in days (3)	Maximum shoreline accumulation (above 100 g/m^2) in m^3 (4)	Minimum time to shoreline contact (above 100 g/m^2) in days (3)	Maximum shoreline accumulation (above 100 g/m^2) in m^3 (4)
Boodie, Double Middle Islands Nature Reserve	Nature Reserve (not Class A)	Unknown	No contact at response threshold 49 days for contact at 10 g/m^2	No contact at response threshold <1 m^3 at 10 g/m^2	No shoreline contact above threshold predicted	No shoreline contact above threshold predicted

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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.

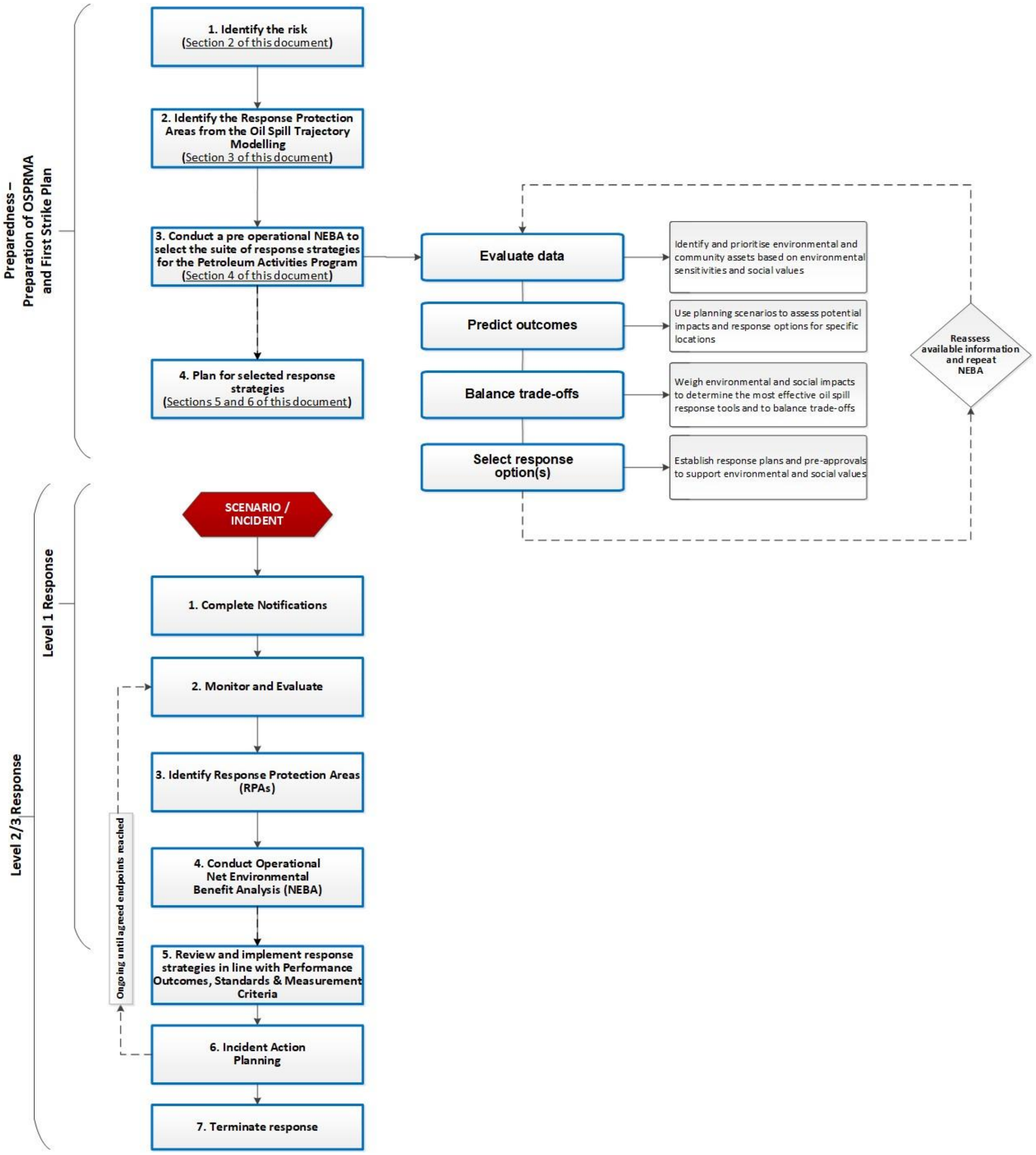

Figure 4-1: Net Environmental Benefit Analysis (NEBA) flowchart

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4.1 Pre-operational / Strategic Net Environmental Benefit Analysis

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 2.3.3**).

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 WCCS is then selected for 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 modelling are then used to assess the feasibility/effectiveness and scale of the response.

Table 4-1: Scenario summary information (WCCS)

Scenario summary information (WCCS - Scenario-01)	
Scenario	Loss of well containment
Location	BAL-5H production well (20° 04’ 14.44” S, 115° 11’ 00.27”E)
Oil Type	Balnaves crude
Fate and Weathering	• 47.7% of the oil mass should evaporate within the first 12 hours (BP < 180 °C); • a further 20.7% should evaporate within the first 24 hours (180 °C < BP < 265 °C); • a further 23.2% should evaporate over several days (265 °C < BP < 380 °C); and • approximately 8.4% of Balnaves Crude is persistent. The residual compounds will tend to remain entrained beneath the surface under conditions that generate wind waves, which will result in biological and photochemical degradation over time scales of several weeks.
Volume and duration of release	Total release: 14,119 m^3 for 67 days
Scenario summary information (Scenario-05)	
Scenario	Hydrocarbon release caused by marine vessel collision.
Location	BAL-5H production well (20° 04’ 14.44” S, 115° 11’ 00.27”E)
Oil Type	Marine diesel oil
Fate and Weathering	• 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); • a further 54% should evaporate over several days (265 °C < BP < 380 °C); and • approximately 5% of diesel is persistent.
Volume and duration of release	550 m^3 – instantaneous

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4.2.1.1 Hydrocarbon characteristics

Balnaves Crude – Credible Scenario-01

Under constant wind, approximately 69% of the Balnaves crude surface hydrocarbons are predicted to evaporate within 24 hours. Under calm conditions, the majority of the remaining oil on the water surface will weather at a slower rate due to being comprised of the longer-chain compounds with higher boiling points. Evaporation of the residual compounds will slow significantly, and they will then be subject to more gradual decay through biological and photochemical processes.

The results of the OILMAP simulation predict that the subsurface discharge will initially generate a cone of rising gas that will entrain the oil droplets and ambient sea water to the sea surface. After the first four weeks the predicted reduction in seabed release rate is expected to lead to the plume to become trapped further below the surface, eventually trapping at depth of around 40 m. The mixed plume is initially forecast to jet towards the water surface with a vertical velocity of around 2.4 m/s, gradually slowing and increasing in plume diameter as more ambient water is entrained. The diameter of the central cone of rising water and oil at the point of surfacing is predicted to be range from approximately 15 m to 50 m.

Given the discharge velocity and turbulence generated by the expanding gas plume, the release is predicted to generate large droplet sizes ranging from 266 µm to 4,917 µm. These droplets will be subject to mixing due to turbulence generated by the lateral displacement of the rising plume. Once reaching the end of the plume phase the oil droplets are expected to rise to the surface relatively quickly due to their strong buoyancy relative to other mixing processes.

The ongoing nature of the release combined with the potential for the plume to breach the water surface may present other hazards, including conditions that may lead to high local concentrations of atmospheric volatiles. These issues should be considered when evaluating the practicality of response operations at or near the blowout site. The results suggest that beyond the immediate vicinity of the blowout most of the released hydrocarbons will be present in the upper layers of the ocean, with the potential for oil to form floating slicks under sufficiently calm local wind conditions.

Marine Diesel - Credible Scenario-05

Marine Diesel is typically classed as an International Tanker Owners Pollution Federation (ITOPF) Group two 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. 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.

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Table 4-2: Oil fate, behaviour and impacts

Stochastic modelling results (WCCS – Credible Scenario-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 100 g/m^2)	No contact at threshold
Stochastic modelling results (Credible Scenario-05)	
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 100 g/m^2)	No contact at threshold

4.2.2 Determining Potential Response Options

The available response techniques based on current technology can be summarised under the following headings:

- Monitor and evaluate (including operational monitoring)
- Source control
    - Remotely operated vehicle (ROV) intervention
    - debris clearance and/or removal
    - capping stack
    - relief well drilling
- Subsea dispersant injection
- Containment and recovery
- In-situ burning
- Mechanical dispersion
- Surface dispersant application:
    - aerial dispersant application
    - vessel dispersant application
- Shoreline protection and deflection
- Shoreline clean-up:
    - Phase 1 – Mechanical clean-up
    - Phase 2 – Manual clean-up
    - Phase 3 – Final polishing
- Oiled wildlife response (including hazing)
- Waste management
- Post spill monitoring/scientific monitoring

An assessment of which response options are feasible for the scenarios is included below in **Table** 4-3 and **Table 4-4**. These options are evaluated against each scenario's parameters including oil

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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 and when and timings throughout the response.

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Table 4-3: Response technique evaluation – Balnaves crude release caused by loss of well containment (Credible Scenario-01)

Response Technique	Effectiveness	Feasibility	Decision	Rationale for the decision
Monitor and evaluate	Will be effective in tracking the location of the spill, informing when it has entered State Waters, 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 which RPAs have been impacted.	Monitoring of a Balnaves crude spill is a feasible response technique and an essential element of all spill response incidents. Outputs will be used to guide decision making on the use of other monitoring/ response techniques and whether the spill passes into State Waters and thus control of the incident moves to WA DoT (if a Level 2/3 event).	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 • determine when control of the spill passes the WA DoT if the spill passes into State Waters (and is a Level 2/3 incident)
Source control via blowout preventer (BOP) intervention	Controlling a loss of well containment at source via BOP intervention would be the most effective way to limit the quantity of hydrocarbon entering the marine environment.	In the event of the worst-case scenario with a loss of well containment, ROV operations to locally operate the BOP would be attempted.	Yes	The use of source control intervention via ROV operations may be feasible and would reduce quantity of hydrocarbons entering the marine environment.
Source control via debris clearance and capping stack	Controlling a loss of well containment at source via capping stack would be an effective way to limit the quantity of hydrocarbon entering the marine environment.	Woodside has developed a project specific source control emergency response plan for the Balnaves Plug and Abandonment activity. Capping the PAP wells is considered feasible based on worst-case discharge rates. Though all capping stack deployment technologies are unproven, in the event of a loss of well containment, the use of a proven subsea deployment method such as a heavy lift vessel, which is more commonly used in industry, is a more reliable and, in turn, ALARP approach. If environmental conditions permit (wind speed, wave height, current and plume radius), deployment of a capping stack would be attempted with a heavy lift vessel. Woodside maintains several frame agreements with various vessel service providers and maintains the ability to call off services with a capping stack and debris clearance agreement. The location of suitable vessels for capping stack deployment are monitored monthly. The supply arrangements and reliability to achieve the required mobilisation time will be revalidated prior to spud. Consideration to mobilise the capping stack from the supplier on a suitable vessel but then hand over to another vessel to conduct the capping activity will also be made to meet response time frames. A site-specific landing force analysis through computational fluid dynamic (CFD) modelling confirms the ability to land the capping stack on either a Xmas tree or BOP.	Yes	Conventional/vertical capping stack deployment with a heavy lift vessel will be attempted at the discretion of the vessel master on the day, giving due regard to the safety of the vessel and crew and consideration to the factors that may influence a safe deployment such as plume conditions and acceptable environmental conditions e.g. wind speed, wave height and current.
Source control via relief well drilling	A subsea release of Balnaves crude will be over approximately 67-days. Relief well drilling will be the primary option to stop the release.	For a spill from one of the PAP wells, relief well drilling will be the primary means of controlling the well containment event. Relief well drilling is a widely accepted and utilised technique.	Yes	Relief well drilling will be the primary technique employed to control a loss of well containment event. The additional impacts introduced from drilling a relief well are comprehensively understood and are low in comparison to an ongoing release of hydrocarbons. Therefore, the environmental benefit for implementing relief well drilling outweighs the risk of implementing the response technique.
Subsea dispersant injection (SSDI)	The treatment of oil at the point of release resulting in a higher encounter rate than surface dispersant application. SSDI requires much less dispersant compared to surface spraying operations	Relatively low release rates and plume concentrations: Gas:oil ratio of 285 – 306 (m^3/m^3), with relatively low oil volume (≤15 m^3/hr) potentially makes accurate targeting of oil content challenging and potential of release of excess dispersant.	No	The application of subsea dispersant injection is unnecessary not expected to provide a net environmental benefit due to relatively low release rates that are predicted, the predicted behaviour of a surface spill coupled with the rapid weathering characteristics of the (Group I) Balnaves crude.

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Response Technique	Effectiveness	Feasibility	Decision	Rationale for the decision
	Subsurface currents and mixing energy may result in rapid three-dimensional dispersion of dispersed oil. SSDI can be applied both day and night and in practically any weather conditions. Dispersed oil at depth will be predominantly small droplets that will not rise as rapidly to the upper water column where there is generally a greater abundance of marine life.			Modelling predicts that surface oil concentrations with the potential to impact fauna (10 g/m2) will be limited to within a maximum of 11 km from the release site. Therefore, reduction of surface oil expression will provide limited environmental benefit. Due to the limited surface oil expression and limited shoreline accumulation, subsea dispersant application will have limited benefit to marine fauna and avifauna at the surface and may result in a net increase in impact to submerged receptors due to increased entrained hydrocarbons and introduction of the dispersants to the water column. Therefore, the use of subsea dispersant injection would unnecessarily introduce additional chemical substances to the marine environment. The additional entrainment of hydrocarbons would also increase exposure of subsea species and habitats to hydrocarbons. Subsea dispersant application also not required for technical/source control purposes (e.g. access to well head by ROV) due to low release rates.
Surface dispersant application	Predicted to be effective on the hydrocarbon based on efficacy testing.	Modelling predicts that appropriate concentrations for surface dispersant would not be present. In addition, Balnaves crude is expected to rapidly weather and evaporate, therefore is not suitable for surface dispersant application.	**No**	The application of dispersant to Balnaves crude is unnecessary as the crude 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.
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 is also likely to lead to unsafe conditions in the vicinity of fresh hydrocarbon.	**No**	Given the poor effectiveness of mechanical dispersion and the associated risk of implementing the response for this activity, this technique is unsuitable for the PAP.
In-situ burning	In-situ burning is only effective where minimum slick thickness can be achieved and where calm metocean conditions can be ensured. Use of this technique would also cause an increase the release of atmospheric pollutants.	There is a limited window of opportunity in which this technique can be applied (prior to evaporation of the volatiles) which would be difficult to achieve. Furthermore, this technique may be prevented from being undertaken due to personnel safety issues arising from predicted high local concentrations of atmospheric volatiles.	**No**	The safety concerns and the predicted low effectiveness associated with implementing an in-situ burning response outweigh the potential environmental benefit.
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. It has the potential to reduce the magnitude, probability, extent, contact and accumulation of hydrocarbon on shorelines receptors when suitable encounter rates can be achieved. It also has the potential to reduce the magnitude and extent of contact with submerged receptors by removing oil before further natural entraining/dissolving of hydrocarbons occurs.	Balnaves crude is expected to weather rapidly and evaporate thus reducing the feasibility of containment and recovery as a response technique.	**No**	Containment and recovery would be an inappropriate response technique as it requires the spilled hydrocarbon to be BAOAC 4 or 5 with a 50-100% coverage of 100 g/m^2 to 200 g/m^2 which a spill of Balnaves crude would not achieve. In addition, most of the Balnaves crude would have been subject to rapid evaporation prior to the commencement of containment and recovery operations.
Shoreline protection and deflection	Shoreline protection and deflection can be effective at preventing contamination of sensitive resources and can be used to corral oil into slicks thick enough to skim effectively.	Use of shoreline protection and deflection for a spill of Balnaves crude is unlikely to provide any significant environmental benefit as the oil will be subject to rapid spreading and evaporation prior to contact with any sensitive areas. Operational monitoring will, however, be deployed from the outset of a spill to track the spill location and fate in real-time. Floating oil above the 10 g/m^2 threshold was not predicted to occur at any shoreline location and so protection and deflection booms are not expected to be effective.	**No**	Protection and deflection is not expected to be effective or provide any net environmental benefit at shoreline locations.
Shoreline clean-up	Based on existing TRPs, shoreline clean-up is expected to be effective at removing hydrocarbon volumes ashore at identified RPAs.	This technique can reduce or prevent impact on sensitive receptors in most cases. Must ensure, through shoreline assessment that sensitive sites will benefit from clean-up activities as the response itself may cause more negative impact than benefit through disturbance of habitats and species.	**Potentially**	Shoreline clean-up may be undertaken if sensitive receptors are impacted at levels that would permit an effective response and only if volatile levels are safe for responders.

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Response Technique	Effectiveness	Feasibility	Decision	Rationale for the decision
		A shoreline clean-up response will mitigate the effects of contact, reducing potential for secondary contamination to other shorelines and wildlife and reduce recovery time. No shoreline accumulation above the 100 g/m^2 threshold was predicted to occur, the minimum concentration required for effective shoreline clean-up. However, three shoreline locations were predicted to have shoreline accumulation above 10 g/m^2. Operational monitoring will, however, be deployed from the outset of a spill to track the spill location and fate in real-time.		
Oiled wildlife response	Oiled wildlife response is an effective response technique for reducing the overall impact of a spill on wildlife. This is achieved through rehabilitation of those already subject to contamination and also through pre-emptive capture/hazing to prevent additional wildlife from being contaminated.	The level of oiled wildlife response can be scalable based on the predicted number of animals oiled. Must be undertaken by qualified, trained wildlife response personnel. Wildlife response typically has a very high mortality rate for seabirds and waders.	**Yes**	This technique may prevent impact to and/or treat oiled wildlife providing net environmental benefit.

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Table 4-4: Response technique evaluation – Marine diesel release caused by marine vessel collision (Credible Scenario-05)

Response Technique	Effectiveness	Feasibility	Decision	Rationale for the decision
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 which 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.	**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 (vessel)	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 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.	Marine diesel is prone to rapid spreading and evaporation thus the use of dispersant would be deemed an unnecessary response technique.	**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.
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 is also likely to lead to unsafe conditions in the vicinity of fresh hydrocarbon.	**No**	Given the poor effectiveness of mechanical dispersion and the associated risk of implementing the response for this activity, this technique is unsuitable for the PAP.
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.	**No**	Given the characteristics of diesel, in-situ burning is not appropriate and would unnecessarily cause an increase the release of atmospheric pollutants.
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.	Marine diesel is prone to rapid spreading and evaporation thus reducing the feasibility of containment and recovery as a response technique.	**No**	Containment and recovery would be an inappropriate response technique as it requires the spilled hydrocarbon to be BAOAC 4 or 5 with a 50-100% coverage of 100 g/m^2 to 200 g/m^2 which a spill of marine diesel would not achieve. In addition, most of the spilled diesel would have been subject to rapid evaporation prior to the commencement of containment and recovery operations.
Shoreline protection and deflection	Shoreline protection and deflection can be effective at preventing contamination of at-risk areas.	Use of shoreline protection and deflection for a spill of marine diesel is unlikely to provide any significant environmental benefit as the diesel will be subject to rapid spreading and evaporation prior to contact with any sensitive areas. Operational monitoring will, however, be deployed from the outset of a spill to track the spill location and fate in real-time. Due to potentially high levels of volatiles from a spill of marine diesel, shoreline protection and deflection would only be undertaken if safe for response personnel.	**No**	Protection and deflection may be deployed to prevent contamination of sensitive resources if operational monitoring identifies areas at risk of impact and only if volatile levels are safe for responders.

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Response Technique	Effectiveness	Feasibility	Decision	Rationale for the decision
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 modelling predicts that no shoreline receptors will be contacted at threshold – any 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	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 would be limited to hazing to ensure the safety of response personnel. 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.

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4.2.3 Exclusion of Response Techniques

Response techniques that are not feasible for both scenarios (Credible Scenario-01 and/or Credible Scenario-05) for the Balnaves P&A are detailed in the subsections below, and are therefore excluded from further assessment within this document.

4.2.3.1 Subsea Dispersant Injection – Balnaves Crude

The relatively low release rates and plume concentrations (Gas:oil ratio of 285 – 306 (m^3/m^3), with relatively low oil volume (≤15 m^3/hr)) potentially makes accurate targeting of oil content within the plume challenging, with potential of release of excess dispersant.

The application of subsea dispersant injection is unnecessary and not expected to provide a net environmental benefit due to relatively low release rates that are predicted, the predicted behaviour of a surface spill coupled with the rapid weathering characteristics of the (Group I) Balnaves crude.

Modelling predicts that surface oil concentrations with the potential to impact fauna (10 g/m^2) will be limited to within a maximum of 11 km from the release site. Therefore, reduction of surface oil expression will provide limited environmental benefit.

Due to the limited surface oil expression and limited shoreline accumulation, subsea dispersant application will have limited benefit to marine fauna and avifauna at the surface and may result in a net increase in impact to submerged receptors due to increased entrained hydrocarbons and introduction of the dispersants to the water column.

Subsea dispersant application is also not required for technical/source control purposes (e.g. access to well head by ROV) due to low release rates.

Therefore, the use of subsea dispersant injection would unnecessarily introduce additional chemical substances to the marine environment. The additional entrainment of hydrocarbons would also increase exposure of subsea species and habitats to hydrocarbons.

4.2.3.2 Surface Dispersant Application

Modelling results for a hydrocarbon release caused by a loss of well containment from Balnaves crude and a loss of marine diesel from vessel collision indicate that surface thresholds for surface dispersant application (>50 g/m^2) will not be reached and shoreline accumulation above threshold accumulated concentrations (>100 g/m^2) was also not reached. Therefore, surface application of dispersant is unlikely to be effective in preventing isolated incidents of accumulation.

Balnaves crude is predicted to rapidly weather and disperse naturally, with only 8.4% predicted to be residual. Similarly, marine diesel is prone to rapid spreading and evaporation. Therefore, the application of dispersant is unnecessary as the crude and 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.

Surface application of dispersants is therefore considered ineffective, with no incremental benefit over natural weathering. It would unnecessarily introduce additional chemical substances to the marine environment and increase exposure of subsea species and habitats to hydrocarbons.

4.2.3.3 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.

4.2.3.4 In-situ Burning

This technique requires calm sea state conditions as is required for containment and recovery operations, which limits its feasibility in the Onslow region. Optimum weather conditions are <20 knot

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wind speed and waves <1 to 1.5 m with oil collected to a minimum 3 mm thick layer. Due to the conditions in the Onslow region it is expected that the ability to contain oil may be limited as the sea state may exceed the optimum conditions. It is preferable that oil is fresh and does not emulsify to maximise burn efficiency and reduce residue thickness.

There are health and safety risks for response personnel associated with the containment and subsequent burning of hydrocarbons. It is also suggested that the residue from attempts to burn would sink, thereby posing a risk to the environment. The longer-term effects of burn residues on the marine environment are not fully understood and therefore, no assessment of the potential environmental impact can be determined.

Until further operational and environmental information becomes available, Woodside will not consider this option.

4.2.3.5 Containment and Recovery

Modelling results for a hydrocarbon release caused by a loss of well containment from Balnaves crude and a loss of marine diesel from vessel collision indicate that surface thresholds required for containment and recovery (>50 g/m^2) will not be reached and shoreline accumulation (>100 g/m^2) was also not reached. Surface hydrocarbon concentrations greater than 10 g/m^2 are predicted to be limited up to a maximum of 11 km from the release location.

It is noted that approximately, 8.4% of Balnaves Crude is persistent and may remain in the marine environment as a residual component. Over the 67-day duration of the release, this residual component represents approximately 1186 m^3. However, surface hydrocarbon concentrations are predicted to weather and disperse rapidly. The modelling predicts that the residual compounds will tend to remain entrained beneath the surface under wind-wave conditions, which will result in a higher rate of biological and photochemical degradation. Given the proportion of entrained oil and the tendency for it to remain mixed in the water column, the remaining hydrocarbons will decay over time scales of several weeks.

Containment and recovery of such low concentrations of dispersed and entrained residual hydrocarbons is not considered practicable. Therefore, containment and recovery are unlikely to be effective in preventing isolated incidents of accumulation.

The effectiveness of containment and recovery is also predicted to be very low based on Onslow met-ocean conditions, the inherent inefficiency of containment and recovery operations, and the light, volatile nature of the Balnaves crude and marine diesel.

4.2.3.6 Shoreline Protection and Deflection

Shoreline surface contact (above thresholds), as a result of a hydrocarbon spill modelling conducted for this petroleum activity program, is not expected to occur. Therefore, shoreline protection and deflection is not considered feasible. As the modelling indicates there is potential for entrained contact and subsequent accumulation at shoreline receptors from Scenario-01, shoreline clean-up has been retained as a feasible response technique for a loss of well control (only). Localised instances of accumulated hydrocarbons are likely to be the result of surface hydrocarbons below threshold concentrations contacting shorelines or entrained hydrocarbons resurfacing and becoming stranded on shorelines.

4.2.3.7 Shoreline Clean-Up – Marine Diesel

The modelling undertaken predicts that a marine 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

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included for assessment. Response thresholds and spill 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. The NEBA can be found in **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**.

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Table 4-5: Selection and prioritisation of response techniques

Response planning scenario	Key characteristics for response planning	Feasibility of response techniques												Outline response technique
		Monitor and evaluate	Subsea dispersant injection	Surface dispersant application	Source control– vessel SOPEP	Source control– capping stack	Source control– relief well drilling	Source control– LWI well control package via ROV or subsea tree	Debris clearance	Containment and recovery	Shoreline protection and deflection	Shoreline clean-up	Oiled wildlife response	
Credible Scenario-01	No shoreline accumulation above 100 g/m^2	Yes	No	No	N/A	Yes	Yes	Yes	Yes	No	No	Potentially	Yes	Monitor and evaluate. Initiate intervention via LWI well control package and ROV Initiate debris clearance. Initiate capping stack deployment Initiate relief well drilling. Plan for shoreline monitoring and clean-up (in liaison with WA DoT) where contact predicted. Plan for oiled wildlife response and implement if oiled wildlife is observed.
Credible Scenario-05	No shoreline accumulation above 100 g/m^2	Yes	N/A	No	Yes	N/A	N/A	N/A	N/A	No	No	No	Yes	Monitor and evaluate. Initiate vessel source control if feasible. Consider shoreline clean-up (in liaison with WA DoT) if safety of responders can be ensured with regard to the potentially high level of volatiles. Plan for oiled wildlife response and implement if oiled wildlife is observed.

From the NEBA undertaken on the WCCS identified, the primary response techniques are;

- Monitor and evaluate (all scenarios)
- Source control – vessel SOPEP (Credible Scenario-05)
- Source control – capping stack (Credible Scenario-01)
- Source control – relief well drilling (Credible Scenario-01)
- Source control – BOP intervention via BOP (Credible Scenario-01)
- Debris clearance (Credible Scenario-01)
- Shoreline clean-up (Credible Scenario-01)

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- Oiled wildlife response (all scenarios)

Support functions include:

- Waste management (all scenarios)
- Scientific monitoring programs (all scenarios)

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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 Hydrocarbon Spill Oil Spill Preparedness and Response Mitigation Assessment (OSPRMA) Development 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; or
    - 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 spill modelling.

For the purpose of the ALARP assessment, the following terms and definitions have been used:

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- 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.

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 operations 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 to the spill event location means that monitoring of the spill can be undertaken in a relatively short timeframe. The primary mobilisation base for initial monitoring activities would be Exmouth. However, in the unlikely event of an extended spill with potential to impact receptors further afield, monitoring activities may also be mobilised from Onslow, Dampier or Karratha.

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.

CS-01:

- Floating surface oil is not predicted to exceed concentrations of 50 g/m^2, the concentration normally preferred for effective operational monitoring. However, surface oil greater than 10 g/m^2 may travel up to 11 km from the well location.
- The shortest timeframe that shoreline accumulation above the 10 g/m^2 threshold is predicted to be 8.3 days at Barrow Island and the Montebello Islands.
- Entrained hydrocarbon concentrations greater than 100 ppb may occur at Rankin Bank in less than 5 days and at eight other island, bank or shoal locations between 5 and 9 days following the release.

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CS-05:

- Floating surface oil is not predicted to exceed concentrations of 50 g/m^2, the concentration normally preferred for effective operational monitoring.
- Entrained hydrocarbons are not expected to exceed concentrations of 500 ppb

All scenarios:

- 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.

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**
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 techniques.	1, 3B, 4
		2.5	For unmanned facility/vessel deploy tracking buoy within 48 hours	1, 3A, 3C, 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 techniques.	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 two 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 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, 2, 3C, 3D, 4

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			• 1 vessel for deploying the monitoring systems with a dedicated winch, A-frame or Hiab and ancillaries to deploy the equipment.	
		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.	
		5.5	Use of Autonomous Underwater Vehicles (AUVs) for hydrocarbon presence and detection may be used as a contingency if the operational NEBA confirms conventional methods are unsafe or not possible.	1, 2, 3C, 4
6	Pre-emptive assessment of sensitive receptors	6.1	Within 2 days, deployment of 2 specialists from resource pool in establishing the status of sensitive receptors.	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 1 week, deployment of 2 specialist(s) in SCAT from resource pool for each of the Response Protection Areas (RPAs) predicted by operational monitoring and/or modelling to be contacted by oil greater than 10 g/m^2.	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
8	Management of environmental impact of the response risks	8.1	Shoreline access routes with the least environmental impact identified will be selected by a specialist in SCAT operations	1

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 grossly 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.

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5.2 Source Control and Well Intervention

The worst-case credible scenario (Credible Scenario-01) for a loss of well containment, is considered to be major damage to, or complete loss of, the Xmas tree from the well. This scenario would result in an uncontrolled flow from the well as outlined in the EP. In the event of a complete break or separation of the tree, the primary response would be relief well drilling.

Woodside is a signatory to a MoU between Australian offshore operators to provide mutual aid to facilitate and expedite mobilising a MODU and drilling a relief well, if an uncontrolled loss of well containment were to occur during well abandonment. The MoU commits the signatories to share rigs, equipment, personnel and services to assist another operator in need.

5.2.1 Response Need Based on Predicted Consequence Parameters

The following statements identify the key parameters upon which a response need can be based:

- Prior to any source control activities, Woodside will implement protocols to ensure that the site is safe including subsea ROV surveys and surface air monitoring.
- Hydrocarbons will flow from the well until one of the following interventions can be made:
    - closure of the Tubing Retrievable Safety Valve (TRSV)
    - a capping stack is in place
    - a relief well is drilled and first attempt at well kill within 67 days.
- 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 may extend up to 67 days with response operations expected to be limited to the same timeframes based on the predicted time to complete shoreline clean-up operations at potentially contacted shoreline locations.

In addition, a number of assumptions are required to estimate the response need for source control. These assumptions have been described in the table below.

Table 5-3: Response Planning Assumptions – Source Control

Response planning assumptions	
Safety considerations	Source control operations cannot be implemented if the safety of response personnel cannot be guaranteed. This requires an initial and ongoing risk assessment of health and safety hazards and risks at the site, in accordance with the Woodside Management System (WMS). Personnel safety issues may include: • hydrocarbon gas and/or liquid exposure • high winds, waves and/or sea states • high ambient temperatures.
Capping stack feasibility considerations	Woodside has developed a project specific source control emergency response plan (SCERP) for the Balnaves Plug and Abandonment activity. Capping the PAP well is considered feasible based on worst-case discharge rates. If safety of response personnel, and plume and environmental conditions permit (wind speed, wave height, current and plume radius), deployment of a capping stack would be attempted with a heavy lift vessel.

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Relief well feasibility considerations	Woodside's primary source control option would be ROV intervention followed by relief well drilling for the Balnaves P&A wells. The following approaches outline Woodside's hierarchy for relief well drilling; • Primary – Review internal drilling programs and MODU availability to source an appropriate rig operating within Australia with an approved Safety Case; • Alternate – Source and contract a MODU through APPEA MOU that is operating within Australia with an approved Safety Case; • Contingency – Source and contract a MODU outside Australia with an approved Australian Safety Case

5.2.2 Environmental Performance Based on Need

Table 5-4: Environmental Performance – Source Control

Environmental Performance Outcome		To stop the flow of hydrocarbons into the marine environment.		
Control Measure		**Performance Standard**		**Measurement Criteria**
9	Subsea First Response Toolkit (SFRT)	9.1	Oceaneering support staff available all year round, via contract, to assist with the mobilisation, deployment, and operation of the SFRT equipment.	1, 3B, 3C
		9.2	Intervention vessel with minimum requirement of a working class ROV and operator.	1, 3C
		9.3	Mobilised to site for deployment within 11 days.	1, 3B, 3C
		9.4	Open communication line to be maintained between IMT and infield operations to ensure awareness of progress against plan(s).	1, 3A, 3B
10	Well intervention	10.1	Frame agreements with ROV providers in place to be mobilised upon notification. ROV equipment deployed within 7 days.	1, 3B, 3C
		10.2	Source control vessel will have the following minimum specifications: • active heave compensated crane, rated to at least 120 T • at least 90 m in length • deck has water/electricity supply • deck capacity to hold at least 110 T of capping stack.	1, 3B, 3C
		10.3	Identify source control vessel availability within 24 hours and begin contracting process. Vessel mobilised to site for deployment within 16 days for conventional capping.	1, 3B, 3C
		10.4	ROV available on MODU ready for deployment within 48 hours to attempt initial BOP well intervention.	1, 3B, 3C
		10.5	Hot Stab and/or well intervention using ROV attempted within 48 hours	1, 3B, 3C
		10.6	Capping stack on suitable vessel mobilised to site within 16 days. Deployment and well intervention attempt will be made once plume, safety and metocean conditions are suitable.	1, 3C
		10.7	Wild Well Control Inc (WWCI) staff available all year round to assist with the mobilisation, deployment, and operation of the capping stack and well intervention equipment.	1, 3B, 3C
		10.8	MODU mobilised to site for relief well drilling within 21 days.	1, 3C
		10.9	First well kill attempt completed within 67 days.	1, 3B, 3C
		10.10	Open communication line(s) to be maintained between IMT and infield operations to ensure awareness of progress against plan(s).	1, 3A, 3B
		10.11	Monthly monitoring of the availability of MODUs through existing market intelligence including current Safety Case history, to meet specifications for relief well drilling. Titleholders of suitable MODUs notified.	3C

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		10.12	At least two communication methods, one of which will include the capability to communicate with aviation.	1, 3A
		10.13	An activity-specific Source Control Emergency Response Plan will be in place prior to commencement of the campaign.	1, 3A, 3C
		10.14	An approved Relief Well Plan (as required by Relief Well Planning Procedure) shall exist prior to undertaking permanent plugging activities, including: feasibility and any specific considerations for relief well kill and well capping	1, 3A, 3C
11	Support vessels	11.1	Monthly monitoring of availability of larger vessels through existing Frame Agreements and market intelligence to meet specifications for source control.	3C
		11.2	Frame agreements for Infield Support Vessels (ISVs) require vessels maintain in-force safety case approvals covering ROV operations and provide support in the event of an emergency.	1, 3B, 3C
		11.3	MODU and vessel contracts include clause outlining requirement for support in the event if an emergency	1, 3C
		11.4	Monthly monitoring of Registered Operators and Woodside will maintain minimum safe operating standards that can be provided to MODU and vessel operators for Safety Case guidance.	1, 3B, 3C
12	Safety case	12.1	Woodside will prioritise MODU or vessel(s) for intervention work(s) that have an existing safety case.	1, 3C
		12.2	Woodside Planning, Logistics, and Safety Officers (on-roster/ call 24/7) to assist in expediting the safety case assessment process as far as practicable.	1, 3C
		12.3	Woodside will maintain minimum safe operating standards that can be provided to MODU and vessel operators for safety case guidance.	1, 3C
		12.4	Balnaves P&A Safety Case includes inspection, maintenance and repair to allow for ROV inspection.	1, 3C

The resulting source control capability has been assessed against the WCCS. The range of techniques provide a feasible and viable approach to relief well drilling operations to stop the well flowing.

- 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 grossly disproportionate to the insignificant environmental benefit gained and/or not reasonably practicable for this PAP.
- 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 6.2**.
- No further control measures that may result in an increased environmental benefit that involve moderate to significant cost and/or dedication of resources have been adopted as the limited scale and timeframe for deployment of this technique does not justify the excessive costs of identified additional, alternative and improved control measures.

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5.3 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 Emergency Plan (SOPEP) triggered by any loss of containment from the PAP vessels.

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.

5.3.1 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 6.7 of the EP. The vessel master’s roles and responsibilities are described in EP Section 7.3.

Performance standards for each contracted PAP vessel are detailed in the vessel’s specific SOPEP.

These standards ensure that sufficient resources are available and are adequately tested to ensure implementation of the SOPEP in the event of a hydrocarbon spill.

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5.4 Shoreline Clean-up

Shoreline clean-up may be undertaken using a broad range of techniques when floating hydrocarbons contact shorelines. The timing, location and extent of shoreline clean-up activities can vary from one scenario to another, depending on the hydrocarbon type, sensitivities and values contacted, shoreline type and access, degree of oiling, and area oiled.

Shoreline clean-up is typically undertaken as a three-phase process, phase one (gross contamination removal) involving the collection of bulk oil, either floating against the shoreline or stranded on it, phase two (moderate to heavy contamination removal) involving removal or in-situ treatment of shoreline substrates such as sand or pebble beaches, and phase three (final treatment or polishing) involving removal of the remaining residues of oil. As phase one typically involves recovery of floating and pooled oil, and phase three removes minor volumes, they have not been considered in the assessment of response need for the scenarios identified.

The *Shoreline Clean-up Operational Plan* details the mobilisation and resource requirements for a shoreline clean-up operation including the logistics, support and facility arrangements to manage the movement of personnel and resources.

The *Shoreline Clean-up Operational Plan* includes the process for the IMT to mobilise resources depending on the nature and scale of the spill. Woodside would activate and mobilise trained and competent personnel in shoreline assessment before or following shoreline contact at response thresholds.

Shoreline clean-up consists of different manual and mechanical recovery techniques to remove hydrocarbons and contaminated debris from a shoreline; this is to minimise ongoing environmental contamination and impact. The National Plan also provides guidance on shoreline clean-up techniques as outlined in National Plan Guidance *Response, assessment and termination of cleaning for oil contaminated foreshores* (AMSA 2015).

5.4.1 Response Need Based on Predicted Consequence Parameters

The following statements identify the key parameters upon which the response need can be based.

CS-01:

- Shoreline accumulation greater than the 100 g/m^2 threshold is not predicted to occur at any location.
- Surface hydrocarbons at concentrations equal to or greater than 1 g/m^2 are not predicted to contact any shoreline.
- The shortest timeframe that shoreline accumulation (greater than 10 g/m^2) is 8.3 days at Barrow Island (2 m^3) and the Montebello Islands (3 m^3) with shoreline accumulation peaking at approximately 9 m^3 in Weeks 3 and 4.
- The duration of the spill may extend up to 67 days with response operations expected to last at least 80 days based on the predicted time to complete shoreline clean-up operations at potentially contacted shoreline locations.

CS-05:

- Shoreline accumulation greater than the 100 g/m^2 or 10 g/m^2 thresholds are not predicted to occur.

All scenarios:

- Pre-emptive assessment and shoreline assessments (OM04 and OM05) will be mobilised prior to shoreline contact.

- Following Shoreline Assessment and agreement of prioritisation with WA Department of Transport, clean-up operations would commence until agreed termination criteria are reached.
- Arrangements for support organisations who provide specialist services (trained personnel, labour hire, shoreline clean-up, and site management equipment) and/or resources and should be tested regularly.
- Tactical Response Plans (TRPs) for Response Protection Areas (RPAs) along with other relevant plans, procedures and support documents should be in developed and in place for Operational and Support functions. These should be reviewed and updated regularly.

In addition, a number of assumptions are required to estimate the response need for shoreline clean-up. These assumptions have been described in the table below.

Table 5-5: Response Planning Assumptions – Shoreline Clean-up

Response planning assumptions: Shoreline clean-up	
Manual shoreline clean-up operation (Phase 2)	One, manual shoreline clean-up operation (Phase 2) may include: • 1–2 x trained supervisor • 8–10 x personnel/labour hire • Supporting equipment for manual clean-up including rakes, shovels, plastic bags etc.
Physical properties	**Surface Threshold** • Lower – 100 g/m^2 - 100% coverage of 'stain' – cannot be scratched off easily on coarse sediments or bedrock • Expected trigger to undertake detailed shoreline survey • Optimum – 250 g/m^2 – 25% coverage of 'coat' – can be scratched off with a fingernail on coarse sediments • Expected trigger to commence clean-up operations
Efficiency **(m^3 oil recovered per person per day)**	Manual shoreline clean-up (Phase 2) - approx. 0.25–1 m^3 oil recovered per person per 10 hr day is based on moderate to high coverage of oil (100 g/m^2–1000 g/m^2) with manual removal using shovels/rakes, etc. from studies of previous response operations and exercises
Field operation supervisors required (per team)	Manual shoreline clean-up (Phase 2) – 1-2 trained supervisor(s) per operation (assumes one team per operation)
Personnel/ labour hire (per team)	Manual shoreline clean-up (Phase 2) – 8-10 personnel/labour hire per operation (assumes one team per operation)

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Table 5-6: Shoreline Clean-up techniques and recommendations

Technique	Description	Shoreline type		Application
		Recommended	Not recommended	
Natural recovery	Allowing shoreline to self-clean; no intervention undertaken.	Remote and inaccessible shorelines for personnel, vehicles and machinery. Other clean-up techniques may cause more damage than allowing the shoreline to naturally recover. Natural recovery may be recommended for areas with mangroves and coral reefs due to their sensitivity to disturbance from other shoreline clean-up techniques. High-energy shorelines: where natural removal rates are high, and hydrocarbons will be removed over a short timeframe. Areas of particular indigenous cultural significance.	Low-energy shorelines: these areas tend to be where hydrocarbon accumulates and penetrates soil and substrates.	May be employed, if the operational NEBA identifies that other clean-up techniques will have a negligible or negative environmental impact on the shoreline. May also be used for buried or reworked hydrocarbons where other techniques may not recover these.
Manual recovery	Use of manpower to collect hydrocarbons from the shoreline. Use of this form of clean-up is based on type of shoreline.	Remote and inaccessible shorelines for vehicles and machinery. Areas where shorelines may not be accessible by vehicles or machinery and personnel can recover hydrocarbons manually. Where hydrocarbons have formed semi-solid to solid masses that can be picked up manually. Areas where nesting and breeding fauna cannot or should not be disturbed.	Coral reef or other sensitive intertidal habitats, as the presence of a response may cause more environmental damage then allowing them to recover naturally. For some high-energy shorelines such as cliffs and sea walls, manual recovery may not be recommended as it may pose a safety threat to responders.	May be used for sandy shorelines. Buried hydrocarbons may be recovered using shovels into small carry waste bags, but where possible the shoreline should be left to naturally recover to prevent any further burying of hydrocarbons (from general clean-up activities).

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Technique	Description	Shoreline type		Application
		Recommended	Not recommended	
Sorbents	Sorbent boom or pads used to recover fluid or sticky hydrocarbons. Can also be used after manual clean-up to remove any residues from crevices or from vegetation.	When hydrocarbons are free-floating close to shore or stranded onshore. As a secondary treatment method after hydrocarbon removal and in sensitive areas where access is restricted.	Access for deploying and retrieving sorbents should not be through soft or sensitive habitats or affect wildlife.	Used for rocky shorelines. Sorbent boom will allow for deployment from small shallow draught vessels, which will allow deployment close to shore where water is sheltered and to aid recovery. Sorbents will create more solid waste compared with manual clean-up, so will be limited to clean rocky shorelines.
Vacuum recovery, flushing, washing	The use of high volumes of low-pressure water, pumping and/or vacuuming to remove floating hydrocarbons accumulated at shorelines.	Suited to rocky or pebble shores where flushing can remobilise hydrocarbons (to be broken up) and aid natural recovery. Any accessible shoreline type from land or water. May be mounted on barges for water-based operations, on trucks driven to the recovery area, or hand-carried to remote sites. Flushing and vacuum may be useful for rocky substrate. Medium- to high-energy shorelines where natural removal rates are moderate to high. Where flushed hydrocarbons can be recovered to prevent further oiling of shorelines.	Areas of pooled light, fresh hydrocarbons may not be recoverable via vacuum due to fire and explosion risks. Shorelines with limited access. Flushing and washing not recommended for loose sediments. High-energy shorelines where access is restricted.	High volume low pressure (HVLP) flushing and washing into a sorbent boom could be used for rocky substrate, if protection booming has been unsuccessful in deflecting hydrocarbons from these areas.

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Technique	Description	Shoreline type		Application
		Recommended	Not recommended	
Sediment reworking	Movement of sediment to surf to allow hydrocarbons to be removed from the sediment and move sand via heavy machinery.	When hydrocarbons have penetrated below the surface. Recommended for pebble/cobble shoreline types. Medium- to high-energy shorelines where natural removal rates are moderate to high.	Low-energy shorelines as the movement of substrate will not accelerate the natural cleaning process. Areas used by fauna which could potentially be affected by remobilised hydrocarbons.	Use of wave action to clean sediment: appropriate for sandy beaches where light machinery is accessible.
Vegetation cutting	Cutting vegetation to prevent oiling and reduce volume of waste and debris.	Vegetation cutting may be recommended to reduce the potential for wildlife being oiled. Where oiling is restricted to fringing vegetation.	Access in bird-nesting areas should be restricted during nesting seasons. Areas of slow-growing vegetation.	May be used on shorelines where vegetation can be safely cleared to reduce oiling.
Cleaning agents (OSCA)	Application of chemicals such as dispersants to remove hydrocarbons.	May be used for manmade structures and where public safety may be a concern.	Natural substrates and in low-energy environments where sufficient mixing energy is not present.	Not recommended for shorelines. Could be used for manmade structures such as boat ramps.

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5.4.2 Environmental Performance Based on Need

Table 5-7: Environmental Performance – Shoreline Clean-up

Environmental Performance Outcome		To remove bulk and stranded hydrocarbons from shorelines and facilitate shoreline amenity habitat recovery.		
Control Measure		**Performance Standard**		**Measurement Criteria**
13	Shoreline responders	13.1	Deployment of 1 shoreline clean-up team to contaminated RPAs comprised of: • 1-2 trained specialists per operation • 8-10 personnel/labour hire Personnel sourced through resource pool within 48 hours of request from the IMT.	1, 2, 3A, 3B, 3C, 4
		13.2	Relevant Tactical Response Plans (TRPs) will be identified in the first strike plan for activation within 24 hours of the release	1, 3A, 3C, 4
		13.3	Clean-up operations for shorelines in line with results and recommendations from SCAT outputs	1, 3A, 3B
		13.4	All shoreline clean-up sites will be zoned and marked before clean-up operations commence.	
		13.5	Mobilise and deploy up to two shoreline clean-up operations by Day 8.	1, 2, 3A, 3C, 4
		13.6	Mobilise and deploy up to 3 shoreline clean-up operations by Week 3.	
		13.7	The safety of shoreline response operations will be considered and appropriately managed. During shoreline clean-up operations: • All personnel in a response will receive an operational/safety briefing before commencing operations • Gas monitoring and site entry protocols will be used to assess safety of an operational area before allowing access to response personnel	1, 3B, 4
		13.8	Open communication line to be maintained between IMT and infield operations to ensure awareness of progress against plan(s)	1, 3A, 3B
14	Shoreline clean-up equipment	14.1	Contract in place with 3rd party providers to access equipment.	1, 3A, 3C, 4
		14.2	Equipment mobilised from closest stockpile (detail in activity specific ALARP) within 5 hours.	
		14.3	Supplementary equipment mobilised from State, AMOSC, AMSA stockpiles within 5 days, if required.	1, 3C, 3D, 4
		14.4	Supplementary equipment mobilised from OSRL within 5 days, if required.	
15	Management of Environmental Impact of the response risks	15.1	If vessels are required for access, anchoring locations will be selected to minimise disturbance to benthic primary producer 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
		15.2	Shallow draft vessels will be used to access remote shorelines to minimise the impacts associated with seabed disturbance on approach to the shorelines	
		15.3	Vehicular access will be restricted on dunes, turtle nesting beaches and in mangroves	
		15.4	Removal of vegetation will be limited to moderately or heavily oiled vegetation	
		15.5	Shoreline access routes with the least environmental impact identified will be selected by a specialist in SCAT operations	
		15.6	Oversight by trained personnel who are aware of the risks	
		15.7	Trained unit leader's brief personnel of the risks prior to operations	

The resulting shoreline clean-up capability has been assessed against the WCCS. The range of techniques provide an ongoing approach to shoreline clean-up at identified RPAs.

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Woodside's capability can cover all required shoreline clean-up operations for the PAP. Given that modelling does not predict shorelines to be impacted above threshold, the shoreline response capability is conservative and Woodside is satisfied that the current capability is managing risks and impacts to ALARP.

The capability available meets the need identified for this activity. The shoreline clean-up capability has the following expected performance (if required during a response):

- Woodside has the capacity to mobilise and deploy up to 12-15 shoreline clean-up teams (approx. 100–180 responders in total) by Day 2 using existing labour hire contracts with Woodside, AMOSC, Core Group, AMSA, WA DoT and OSRL team leads.
- The available capability exceeds the shoreline clean-up requirements of the WCCS (CS-01) which, based on modelling predictions, may benefit from up to two shoreline clean-up operations by Day 8 and three clean-up operations by Week 3.
- Pre-emptive assessment and shoreline assessments (OM04 and OM05) will be mobilised prior to shoreline contact to determine if shoreline clean-up is feasible and necessary.
- Assessment of response capability, therefore, indicates that for a worst-case scenario the actual teams required would meet the available capability and the response would be completed by end month 2.
- Woodside has considered deployment of additional personnel to undertake shoreline clean-up operations but is satisfied that the identified level of resource is balanced between cost, time and effectiveness. The most significant constraint on expanding the scale of response operations is the availability of accommodation and transport services in the region between Exmouth and Dampier and management of response generated waste. From previous assessment of accommodation in this region, Woodside estimates that current accommodation can cater for a range of 500 to 700 personnel per day for an ongoing operation.
- TRPs have been developed for all identified RPAs.
- 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**.
- No further control measures that may result in an increased environmental benefit that involve moderate to significant cost and/or dedication of resources have been adopted as the limited scale and timeframe for deployment of this technique does not justify the excessive costs of identified alternate, improved or additional controls.

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5.5 Oiled Wildlife Response (Including Hazing)

Woodside would implement a response in accordance with the Western Australian *Oiled Wildlife Operational Plan* (WA OWRP). 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 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 fauna 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 Karratha. Additional personnel would be sourced through Woodside's arrangements to support an oiled wildlife response as required.

5.5.1 Response Need Based on Predicted Consequence Parameters

The following statements identify the key parameters upon which a response need can be based.

CS-01:

- Surface hydrocarbons greater than 10 g/m^2 may travel up to a maximum of 11 km and are limited to Commonwealth waters.
- Shoreline accumulation greater than the 100 g/m^2 threshold is not predicted to occur at any location.
- The shortest timeframe for shoreline accumulation (greater than 10 g/m^2) is 8.3 days at Barrow Island (2 m^3) and the Montebello Islands (3 m^3) with shoreline accumulation peaking at approximately 9 m^3 in Weeks 3 and 4.

CS-05:

- Surface hydrocarbon concentrations greater than 10 g/m^2 may travel up to a maximum of 85 km.
- Shoreline accumulation greater than the 100 g/m^2 or 10 g/m^2 thresholds are not predicted to occur.

All scenarios:

- Pre-emptive assessment and shoreline assessments (OM04 and OM05) will be mobilised prior to shoreline contact.
- The offshore location of the release site is expected to initially result in low numbers of at-risk or impacted wildlife.
- It is estimated that an oiled wildlife response would be between Level 1 and 3, as defined in the WA OWRP.

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Table 5-8: Key at-risk species potentially in Priority Protection Areas and open ocean

Species	Open ocean	Ningaloo Coast	Muiron Islands	Barrow Island and Montebello Islands	Pilbara Islands – Southern Group
Marine turtles (including foraging and inter-nesting areas and significant nesting beaches)	✓	✓	✓	✓	✓
Whale sharks (migration to and from waters at Ningaloo)	✓	✓	✓	✓	
Seabirds and/or migratory shorebirds	✓	✓	✓	✓	✓
Cetaceans – migratory whales	✓	✓	✓	✓	
Cetaceans – dolphins and porpoises	✓	✓	✓	✓	✓
Dugongs		✓	✓	✓	✓
Sea snakes	✓	✓	✓	✓	✓

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 5-9** below.

Table 5-9: 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 fauna from entering areas potentially contaminated by spilled hydrocarbons, as well as dispersing, displacing or relocating fauna 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 Exmouth and Onslow 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.

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Stage	Description
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 fauna 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 fauna 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 Exmouth and Onslow 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 DBCA and use the capability outlined in the WA OWRP, with additional capability if required (e.g. volunteers) accessible through Woodside's *People and Global Capability Surge Labour Requirement Plan*.

The WA OWRP provides indicative oiled wildlife response levels (**Table 5-10**) and the resources likely to be needed at each increasing level of response.

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Table 5-10: Indicative oiled wildlife response level (adapted from the WA OWRP, 2014)

OWR 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	None	None	None	None	None
Level 2	26	> 4–14 days	1–5/day < 20 total	None	< 20 hatchlings No juv/adults	None	None	None
Level 3	59	> 4–14 days	5–10/day	1–5/day < 10 total	< 5 juv/adults < 50 hatchlings	None	< 5	None
Level 4	77	> 4–14 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	> 4–14 days	10–100/ day > 200 total	10–50/day	> 20 juv/adults > 500 hatchlings	< 5 dolphins	> 50	Dugongs oiled
Level 6	122	> 4–14 days	> 100/day	10–50/day	> 20 juv/adults > 500 hatchlings	> 5 dolphins	> 50	Dugongs oiled

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5.5.2 Environmental Performance Based on Need

Table 5-11: Environmental Performance – Oiled Wildlife Response

Environmental Performance Outcome		Oiled Wildlife Response is conducted in accordance with the WA OWRP to ensure it is conducted in accordance with legislative requirements to house, release or euthanise fauna under the Animal Welfare Act 2002.		
Control Measure		**Performance Standard**		**Measurement Criteria**
16	Wildlife response equipment	16.1	Contracted capability to treat 100 individual fauna for immediate mobilisation to Response Priority Areas (RPAs)	1, 3A, 3B, 3C, 4
		16.2	Contracted capability to treat up to an additional 250 individual fauna within a five-day period.	
		16.3	National plan access to additional resources under the guidance of the DoT (up to a Level 5 oiled wildlife response as specified in the OWRP), with the ability to treat about 600 individual fauna by the time hydrocarbons contact the shoreline.	1, 3C, 4
		16.4	Vessels used in hazing/pre-emptive capture will approach fauna at slow speeds to ensure animals are not directed towards the hydrocarbons.	1, 3A, 3B, 4
		16.5	Facilities for the rehabilitation of oiled wildlife are operational 24/7 as per WA OWRP.	1, 3A, 4
17	Wildlife responders	17.1	2 wildlife divisional commanders to lead the oiled wildlife operations who have completed an Oiled Wildlife Response Management course	1, 2, 3B
		17.2	Wildlife responders to be accessed through resource pool and additional agreements with specialist providers	1, 2, 3A, 3B, 3C, 4
		17.3	Oiled wildlife operations (including hazing) would be implemented with advice and assistance from the Oiled Wildlife Advisor from the DBCA.	1
		17.4	Open communication line to be maintained between IMT and infield operations to ensure awareness of progress against plan(s)	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, during the subsea or surface release the capability available meets the need identified. It indicates that, the wildlife response capability has the following expected performance:

- Mobilisation and deployment of approximately two wildlife collection teams within the first 5 days of the incident which may provide an oiled wildlife response in offshore waters prior to hydrocarbons reaching any shoreline locations.
- Mobilisation and deployment of the two wildlife collection teams at potentially contacted Barrow Island and the Montebello Islands by Day 8.
- Mobilisation and deployment of the two wildlife collection teams at other potentially contacted shorelines by Weeks 3 and 4.
- Mobilisation and deployment of two central wildlife treatment and rehabilitation locations at Exmouth and Onslow in accordance with WA OWRP.

Wildlife collection operations would be expected to be completed by Month 3 based on the predicted duration of the release. Additional capability could be deployed but given modelling predicts ongoing limited or no shoreline contact above threshold, additional personnel are unlikely to increase the net environmental benefit and this capability is considered to be a manageable balance between effectiveness and minimising environmental impact

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 Exmouth or Onslow.

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5.6 Waste Management

Waste management is considered a support technique to wildlife response, containment and recovery and shoreline clean-up. Waste generated and collected during the response that will require handling, management and disposal may consist of:

- Liquids (hydrocarbons and contaminated liquids) collected during wildlife response, containment and recovery and shoreline clean-up, and/or
- Solids/semi-solids (oily solids, garbage, contaminated materials) and debris (e.g. seaweed, sand, woods, and plastics) collected during wildlife response, containment and recovery and shoreline clean-up.

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* (Woodside doc. W0000AH9675798) details the procedures, capability and capacity in place between Woodside and its primary waste services contractor (Veolia Waste Management) to manage waste volumes generated from response activities.

5.6.1 Response Need Based on Predicted Consequence Parameters

Table 5-12: Response Planning Assumptions – Waste Management

Response planning assumptions: Waste management	
Waste **loading per m^3 oil recovered (multiplier)**	Containment and Recovery – approx. 10x multiplier for oily waste generated by containment and recovery operations
	Shoreline clean-up (manual) – approx. 5-10x multiplier for oily solid and liquid wastes generated by manual clean-up
	Oiled wildlife response – approx. 1m^3 of oily liquid waste generated for each wildlife unit cleaned

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5.6.2 Environmental Performance Based on Need

Table 5-13: 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**
18	Waste Management	18.1	Contract with waste management services for transport, removal, treatment and disposal of waste	1, 3A, 3B, 3C, 4
		18.2	Access to at least 50 m^3 of solid and liquid waste storage available within 1 week upon activation of 3rd party contract.	
		18.3	Access to up to 200 m^3 by end of week 3.	
		18.4	Decanting in accordance with National Plan guidelines to occur in daylight hours into the apex of the boom once hydrocarbon/water has settled in storage container.	
		18.5	Recovered hydrocarbons and wastes will be transferred to licensed treatment facility for reprocessing or disposal.	
		18.6	Teams will segregate liquid and solid wastes at the earliest opportunity.	
		18.7	Waste management provider support staff available year-round to assist in the event of an incident with waste management as detailed in contract.	
		18.8	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
		18.9	Waste management to be conducted in accordance with Australian laws and regulations	1, 3A, 3B, 3C, 4
		18.10	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 the largest shoreline volumes ashore are predicted during Week 3 at a maximum volume of 9 m^3, 182 m^3 of waste is expected across all shoreline clean-up operations, and the capability available greatly exceeds the need identified.

It indicates that the waste management capability has the following expected performance:

- 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**.
- Woodside has assessed the existing capability available and considered potential alternative, additional and improved control measures. Woodside currently has access to service providers committed to collecting approximately 120,000 m^3 liquid waste over 77 days (approximately 1,600 m^3 per day) from an offshore response or 64,000 m^3 solid waste over 130 days for shoreline clean-up.
- The waste management requirements of all credible spill scenarios are well 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 (**Section 6.3**).
- No further control measures that may result in an increased environmental benefit that involve moderate to significant cost and/or dedication of resources have been adopted

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as the requirements of this technique does not justify the excessive costs of identified alternate, improved or additional controls.

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5.7 Scientific Monitoring

A scientific monitoring program (SMP) 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 Environment that Maybe Affected (EMBA) and in particular, any identified Pre-emptive Baseline Areas (PBAs) for the credible spill scenarios or other identified unplanned hydrocarbon releases associated with the Petroleum Activities Program (PAP) (refer to Table 2-1: PAP credible spill scenarios).

The outputs of the stochastic hydrocarbon spill modelling are used to assess the environmental risk, in terms of delineating which areas of the marine environment are predicted to be exposed to hydrocarbons exceeding environmental threshold concentrations (refer to **Table 2-2**, **Section 2.3.1.1**). The summary of all the locations where hydrocarbon thresholds could be exceeded by any of the simulations modelled is defined as the EMBA. The Petroleum Activities Program worst-case credible spill scenario 01 (CS-01) and credible scenario 05 (CS-05) 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 may 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 scientific monitoring program 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.

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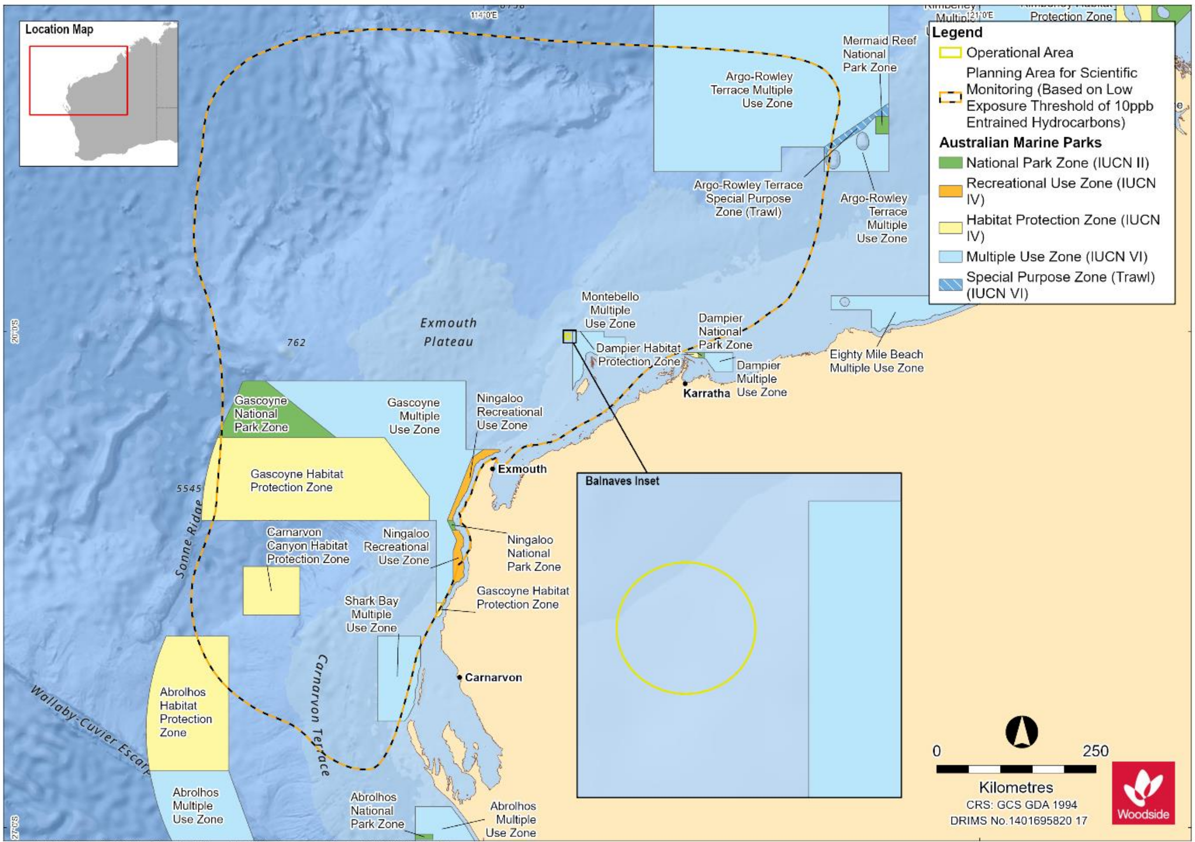
These SMPs have been designed to cover all key tropical and temperate habitats and species within Australian waters and broader, if required. A planning area for scientific monitoring is also identified to acknowledge potential hydrocarbon contact below the environmental threshold concentrations and 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.



Sources: Esri, HERE, Garmin, GEBCO, National Geographic, NOAA, and the GIS User Community, Esri, Garmin, GEBCO, NOAA NGDC, and other contributors

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 (CS-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 CS-01 and therefore represents the largest spatial boundaries of the 100 spill combinations for CS-01, not the spatial extent of a single spill trajectory for CS-01.

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5.7.1 Scientific Monitoring Deployment Considerations

Scientific Monitoring Deployment Considerations	
Existing baseline studies for sensitive receptor locations predicted to be affected by a spill	Pre-emptive Baseline Areas (PBAs) of the following two categories: • PBAs within the predicted <10-day hydrocarbon contact time prediction: As part of this assessment, the approach was 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 (based on the EMBA). Then investigate the need to conduct baseline data collection to address data gaps and demonstrate spill response preparedness (refer to Annex D). In the scenario, that baseline data needs are identified, 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 predicted >10 days time to predicted hydrocarbon contact in the event of an unplanned hydrocarbon release. As part of this assessment, a desktop review is conducted of available and appropriate baseline data for key receptors for locations (if any) that are potentially impacted >10 days' time of a hydrocarbon spill event and documented (refer to Section 5.7.2). In the event of a spill, the SMP activation (as per the Balnaves Plug and Abandonment First Strike Plan) directs the SMP team to follow the steps outlined in the SMP Operational Plan. The steps include: checking the review of the available and type of existing baseline data, with particular reference to any Pre-emptive Baseline Areas (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 (refer to Section 5.7.2) and the process, 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 as the field operational limits for implementing SMPs: • Waves <1 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.

5.7.2 Response Planning Assumptions

Response Planning Assumptions	
Pre-emptive Baseline Areas (PBAs)	Pre-emptive Baseline Areas (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 exist or are planned for and data collection may commence pre-PAP (≤ 10 days minimum time to contact). • PBAs (> 10 days minimum time to contact) for which baseline data may be collected in the event of an unplanned hydrocarbon release. In the event of a spill, response phase PBAs are prioritised for SMP activities based on vulnerability (i.e. time to contact and environmental sensitivity) and potential impacts from hydrocarbon contact as well as the identified need to acquire baseline data.

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	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 the activity. 1. The PBAs for the PAP (Balnaves Plug and Abandonment) are identified and listed in Annex D, Table D-1. The listed PBAs, together with the situational awareness (provided by the operational monitoring) are the basis for the response phase SMP planning and implementation.
Pre-Spill	Activity: Balnaves Plug and Abandonment A review of existing baseline data for receptor locations (refer to Annex D, Table D-1) with potential to be contacted by surface, dissolved or entrained hydrocarbons at environmental thresholds within ≤10 days, relating to the worse case credible hydrocarbon release – CS-01 and CS-05 for the activity has identified the following: • Rankin Bank • Barrow, Montebello and Lowendal Offshore Island Groups • Southern Pilbara Island Group Australian Marine Parks (AMPs) potentially affected includes: • Montebello AMP • All the Australian Marine Parks (AMPs) are located in offshore waters where hydrocarbon exposure is possible from floating (on surface waters) and entrained (in the water column) hydrocarbons.
In the Event of a Spill	Receptor locations with >10 days to hydrocarbon contact, as well as the wider area, will be investigated and identified by the SMP team (in the Environment Unit of the 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). The full list is presented in Annex D, based on the PAP credible spill scenario(s) (Table 2-1). To address the initial focus in a response phase SMP planning situation, receptor locations predicted to be contacted >10 days have been identified as follows: • Ningaloo coast (including WHA, AMP and State Marine Park) • Muiron Islands (WHA, State Marine Park) • Glomar Shoal Australian Marine Parks (AMPs) potentially affected includes: • Gascoyne AMP All the Australian Marine Parks (AMPs) are located in offshore waters where hydrocarbon exposure is possible from floating (on surface waters) and entrained (in the water column) hydrocarbons. The unfolding spill affected area predictions and confirmation of appropriate baseline data will determine the selection of receptor locations and SMPs to be activated in order to gather pre-emptive (pre-hydrocarbon contact) data. Refer to ANNEX C for further details on scientific monitoring plan implementation and delivery). The timing of SMP activation and mobilisation of the individual SMPs to undertake data collection will be decided and documented by the Woodside SMP team following the process outlined in the SMP Operational Plan. In the event 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 for the following purposes: i. Priority will be given to the collection of baseline data for receptors predicted to be within the spill affected area prior to hydrocarbon contact. The process is initiated with the investigation of available baseline and time to hydrocarbon contact (>10 days which is sufficient time to mobilise SMP teams and acquire data before hydrocarbon contact). With reference to the activity, priority would be focused on Ningaloo coast.

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	ii. Collect baseline data for receptors predicted to be outside the spill affected area so reference datasets for comparative analysis with impacted receptor types can be assessed post-spill.
Baseline Data	A summary of the spill affected area and receptor locations as defined by the EMBA for the PAP (PAP) credible spill scenarios 01 and 05 are presented in Section 2.3.6. The key receptors at risk by location and corresponding SMPs based on the EMBA for the PAP are presented in ANNEX D, Table D-1, as per the worse credible spill event CS-01. This matrix maps the receptors at risk with their location and the applicable SMPs that may be triggered in the event of a Level 2 or 3 hydrocarbon release, or any release event with the potential to contact sensitive environmental receptors. Receptor locations and applicable SMPs are colour coded to highlight possible time to contact based on receptor types and locations. The status of baseline studies relevant to the PAP are tracked by Woodside through the maintenance of a SMP Environmental Baseline Database (managed by the Woodside Environmental Science team), as well as accessing external databases such as the Department of Water and Environmental Regulation (WA) Index of Marine Surveys for Assessment (IMSA)[1] .

5.7.3 Summary – Scientific Monitoring

The resulting scientific monitoring capability has been assessed against the PAP credible spill scenarios. The range of techniques 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.

5.7.4 Response Planning: Need, Capability and Gap – Scientific Monitoring

The receptor locations identified in Annex D provide the basis of the SMPs likely to be selected and activated. Once the Woodside SMP Delivery team and the SMP standby contractor have been stood up and the exact nature and scale of the spill becomes known, the SMPs to be activated will be confirmed as per the process set out in the SMP Operational Plan.

<u>Scope of SMP Operations in the event of a hydrocarbon spill:</u>

Receptor locations of interest for the SMP during the response phase are:

- Barrow, Montebello and Lowendal Offshore Island Groups (predicted hydrocarbon contact <10 days)
- Ningaloo Coast and Muiron Islands (predicted hydrocarbon contact >10 days)

Documented baseline studies are available for certain receptor locations including for Rankin Bank, Barrow Island, Montebello and Lowendal Offshore Island Groups (Annex D, Table D-2). The SMP approach however, would be to deploy SMP teams to maximise the opportunity to collect pre-emptive data at sensitive receptor locations that may include receptors aound Barrow Island, Montebello and Lowendal Island Groups and the Ningaloo Coast. 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 ALARP assessment for the SMP (Section 6.7 considers alternate, additional, and/or improved control measures on each selected response technique.

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[1] https://biocollect.ala.org.au/imsa#max%3D20%26sort%3DdateCreatedSort

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5.7.5 Environmental Performance Based on Need

Table 5-14: 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**
19	• Woodside has an established and dedicated SMP team comprising the Environmental Science Team and additional Environment Advisers within the HSE Function.	19.1	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
20	• Woodside have a SMP standby contractor to provide scientific personnel to resource a base capability of one team per SMP (SM01-SM10, see Table C-2, ANNEX C) 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 other sources including Woodside's Environmental Services Panel.	20.1	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 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	• OSPU Internal Control Environment tracks the quarterly review of the Oil Spill Contracts. • SMP resource report of personnel availability provided by SMP contractor on monthly basis (SMP resourcing report register). • Training materials • Training attendance registers • Competency criteria for SMP roles • SMP annual arrangement testing and reporting
21	• 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 well control response. • SMP Team structure, interface with SMP standby contractor (standby SMP 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 First Strike Response Plan (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 Incident Action Plan (IAP) as per the identified ICC timed sessions and the SMP IAP logged on the online IMIS • 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 contractor. • Woodside Environmental Science Team co-ordinates an annual SMP arrangement testing exercise which the SMP standby contractor	21.1	• 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

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22	• 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 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 and if additional surge capacity is required this would be available through the other Woodside Environmental Services Panel Contractors and specialist contractors. SMP standby contractor can also address equipment redundancy through either individual or multiple suppliers. MoUs are in place with one marine sampling equipment company and one analytical laboratory (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 'to acquire, where practicable, the environmental baseline data prior to hydrocarbon contact required to support the post-response SMP'.	22.1	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 SMP standby contractor as detailed within the SMP Implementation Plan.	• OSPU Internal Control Environment (DRIMS 10263416) tracks the quarterly review of the Oil Spill Contracts • SMP standby monthly resource reports of equipment availability provided by SMP contractor (SMP resourcing report register). • SMP annual arrangement testing and reporting
23	Woodside's SMP approach addresses the pre-PAP acquisition of baseline data for Pre-emptive Baseline Areas (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. • Accessing external databases such as the Department of Water and Environmental Regulation (WA) Index of Marine Surveys for Assessment (IMSA) (refer to ANNEX C: Oil Spill Scientific Monitoring Program).	23.1	• 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

Environmental Performance Outcome		SMP plan to acquire response phase monitoring targeting pre-emptive baseline data achieved		
Control measure		**Performance Standard**		**Measurement Criteria**
24	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.	24.1	**Pre-emptive Baseline Area (PBA) baseline data acquisition in the response phase** If baseline data gaps are identified for PBAs predicted to have hydrocarbon contact in >10 days, there will be a response phase effort to collect baseline data. Priority in implementing SMPs will be 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.	• Response SMP plan • Woodside's online Incident Management System Records • SMP component of the Incident Action Plan.
		24.2	**Post Spill contact** 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).	• SMP planning document • SMP Decision Log • Incident Action Plans (IAPs)
Environmental Performance Outcome		Implementation of the SMP (response and post-response phases)		
Control measure		**Performance Standard**		**Measurement Criteria**
25	• Scientific monitoring will address quantitative assessment of environmental impacts of a level 2 or 3 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.	25.1	**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	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
			Implementation of SM02-SM10	Evidence SMPs have been triggered:

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	- 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.		SM02-SM10 will be implemented in accordance with the objectives and activation triggers as per Table C-2 of Annex C.	- 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
		25.2	**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).	Evidence of Termination Criteria triggered: - Documentation and approval by relevant stakeholders to end SMPs for specific receptor types.

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5.8 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.

5.8.1 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 incident action plan (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 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.

5.8.2 Operational Net Environmental Benefit Analysis Process

In the event of a response Woodside will confirm that the response techniques adopted at the time of Environment Plan/Oil Pollution Emergency Plan (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 Oil Pollution Emergency Arrangements (Australia). In effect the operational NEBA will determine whether there is net environmental benefit to continue response operations.

5.8.3 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 First-Strike Response Plan). 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.

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5.8.4 Environmental Performance Based on Need

Table 5-15: 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**
26	Operational NEBA	26.1	Confirm that the response techniques adopted at the time of acceptance remain appropriate to reduce the consequences of the spill within 24 hours.	1, 3A
		26.2	Record the evidence and justification for any deviation from the planned response activities.	
		26.3	Record the information and data from operational and scientific monitoring activities used to inform the NEBA.	
27	Stakeholder engagement	27.1	Prompt and record all notifications (including government notifications) for stakeholders in the region are made	
		27.2	In the event of a response, identification of relevant stakeholders will be re-assessed throughout the response period.	
		27.3	Undertake communications in accordance with: • Woodside Crisis Management Functional Support Team Guideline – Reputation (Link) • External Communication and Continuous Disclosure Procedure (Link) • External Stakeholder Engagement Procedure (Link)	
28	Personnel required to support any response	28.1	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.	1, 3B
		28.2	A duty roster of trained and competent people will be maintained to ensure that minimum manning requirements are met all year round.	3C
		28.3	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 • Finance Coordinator.	1, 2, 3B, 3C, 4
		28.4	Collect and interpret information from the scene of the incident to determine support requirements to the site-based IMT, develop an Incident Action Plan (IAP) and assist with the execution of that plan.	
		28.5	S&EM advisors will be integrated into ICC to monitor performance of all functional roles.	
		28.6	Continually communicate the status of the spill and support Woodside to determine the most appropriate response by delivering on the responsibilities of their role.	
		28.7	Follow the OPEA, Operational Plans, FSPs, support plans and the IAPs developed.	1, 2, 3A, 4
		28.9	Contribute to Woodside's response in accordance with the aims and objectives set by the Duty Manager.	1, 2, 3B, 3C, 4

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5.9 Measurement Criteria for all Response Techniques

Woodside ensures compliance with environmental performance outcomes and standards through four primary mechanisms. The aforementioned performance tables 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 and 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 and 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 Incident Action Plan (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 S&EM Competency Dashboard

The 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
- Australian Marine Oil Spill Centre (AMOSC) core group
- AMOSC
- Oil Spill Response Limited (OSRL)
- Marine Spill Response Corporation (MSRC)
- AMSA
- Woodside contracted workforce

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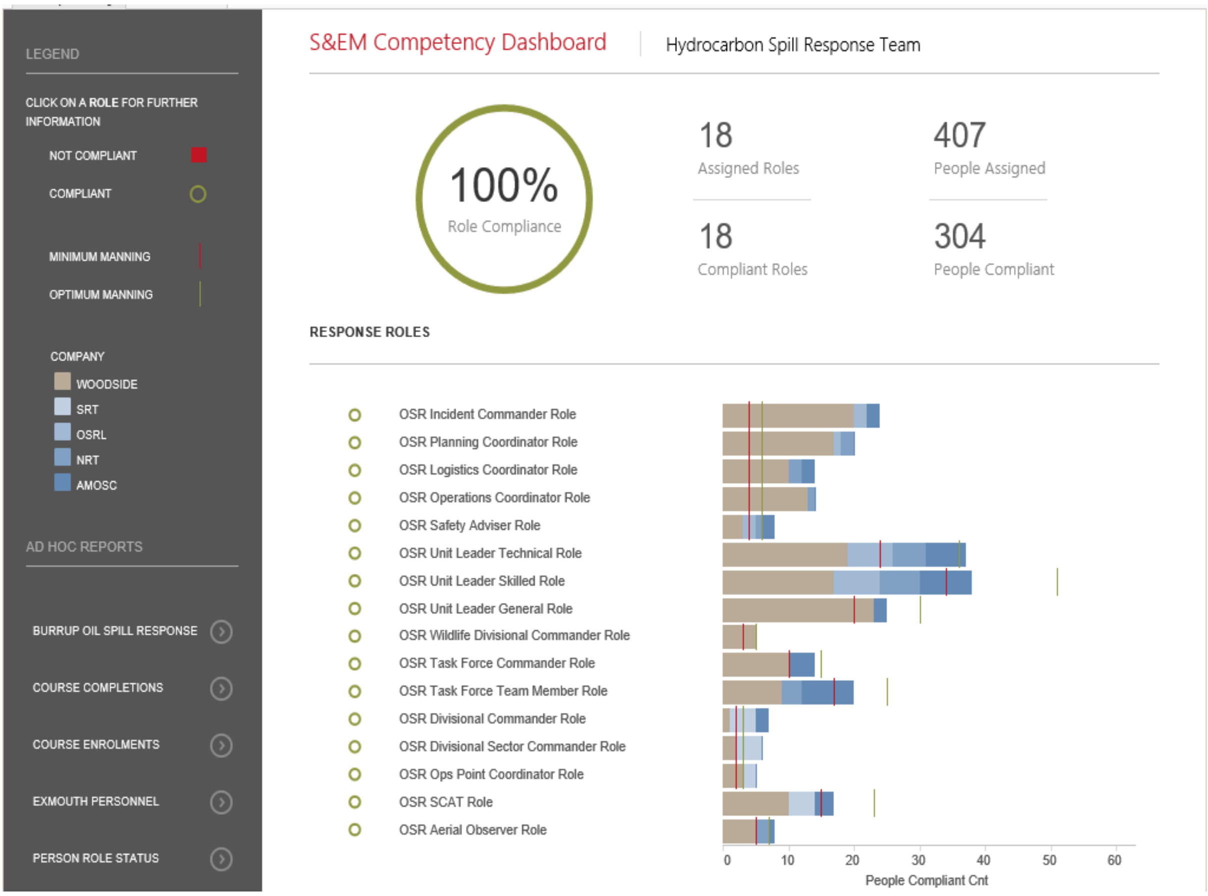


S&EM Competency Dashboard | Hydrocarbon Spill Response Team

100% Role Compliance

18 Assigned Roles	407 People Assigned
18 Compliant Roles	304 People Compliant

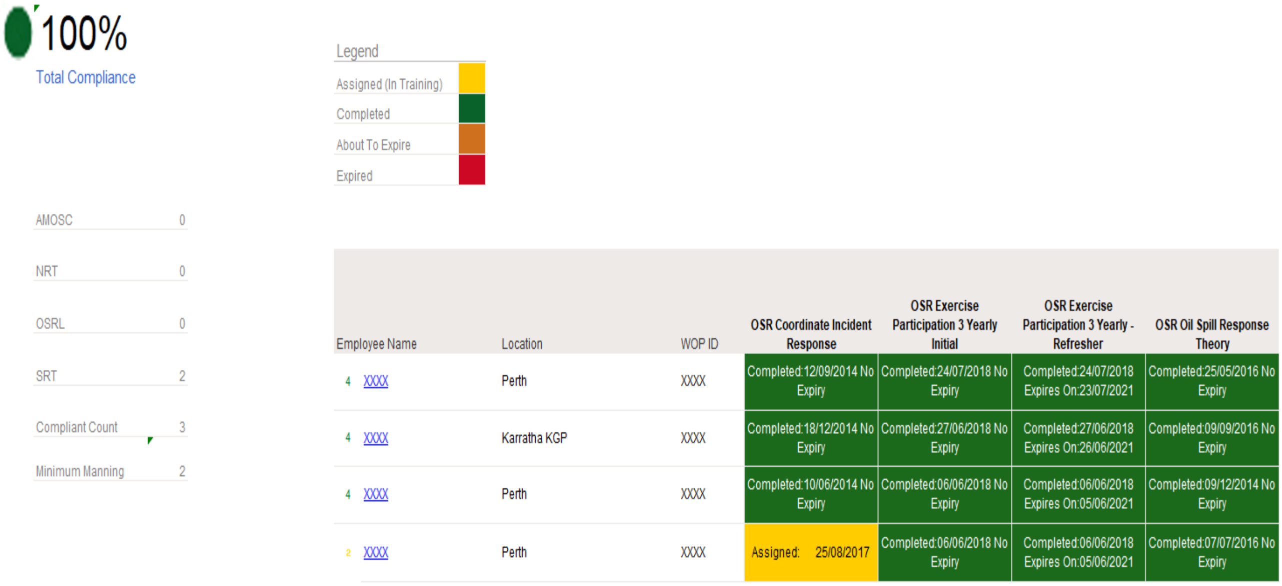
RESPONSE ROLES

- ○ OSR Incident Commander Role
- ○ OSR Planning Coordinator Role
- ○ OSR Logistics Coordinator Role
- ○ OSR Operations Coordinator Role
- ○ OSR Safety Adviser Role
- ○ OSR Unit Leader Technical Role
- ○ OSR Unit Leader Skilled Role
- ○ OSR Unit Leader General Role
- ○ OSR Wildlife Divisional Commander Role
- ○ OSR Task Force Commander Role
- ○ OSR Task Force Team Member Role
- ○ OSR Divisional Commander Role
- ○ OSR Divisional Sector Commander Role
- ○ OSR Ops Point Coordinator Role
- ○ OSR SCAT Role
- ○ OSR Aerial Observer Role

Figure 5-2: Example screen shot of the HSP 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 Ops Point Coordinator role and the training modules required to show competence.



100%
Total Compliance

Legend
- Assigned (In Training) 🟨
- Completed 🟩
- About To Expire 🟧
- Expired 🟥

AMOSC	0
NRT	0
OSRL	0
SRT	2
Compliant Count	3
Minimum Manning	2

	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 screen shot for the Ops Point Coordinator role

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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: Oil Pollution Emergency Arrangements, first strike response plans, operational plans, support plans and tactical response plans) 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[5] vessel schedule, dispersant availability, rig/vessels monitoring, equipment stockpiles, tracking buoy locations and the CICC duty roster.

d) **Compliance and 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 and 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 Oil Pollution Emergency Plan (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
  - Maintaining access to identified equipment and personnel.
- Planning for hydrocarbon spill response preparedness
- Accountabilities for hydrocarbon spill response preparedness

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[5] The Integrated fleet consists of vessels from multiple operators that have been contracted to Woodside to undertake a number of duties including hydrocarbon spill response

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- 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

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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. A$300,000.	This option is not adopted as the minimal environmental benefit gained is disproportionate to the cost and complexity of its implementation.	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. A$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 A$200 per day or A$6000 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 and 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 A$2000 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 contractor has person on call to respond from their own location.	Modelling service with a faster activation time would be achieved via membership of an alternative modelling service at an annual cost of A$50,000 for 24hr access plus an initial A$5000 per modelling run.	This option is not adopted as the minimal environmental benefit gained is disproportionate to the cost and complexity of its implementation.	No

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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*					
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. A$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. A$1 m 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

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6.2 Source Control – ALARP Assessment

Woodside has based its response planning on the worst-case credible scenarios (as described in Section 2.2). This includes the following selection of primary source control and well intervention techniques which would be conducted concurrently:

- ROV intervention
- debris clearance and/or removal
- capping stack
- relief well drilling.

6.2.1 ROV Intervention

Following confirmation of an emergency event, Woodside would mobilise inspection class ROVs via existing frame agreements to undertake inspection activities. The ROV available on the MODU can be deployed within 48 hours. Should the ROV on the MODU be unavailable, work class ROVs are also available through the existing frame agreements and are available for deployment within seven days (**Table 6-1** and **Figure 6-1**).

As Woodside holds Frame Agreements for vessels along with contracts for ROV providers and pilots, inspection activities using ROVs are expected to commence within seven days.

Table 6-1: ROV timings

	Estimate ROV inspection duration for PAP wells
Source and mobilise vessel with work class ROV	2 days
Liaise with Regulator regarding risks and impacts*	4 days
Undertake ROV Inspection	1 day
TOTAL	**7 days***

** Based on timings from the Report into the Montara Commission of Enquiry, submission and discussion of revised documentation for limited activities inside the Petroleum Safety Zone (water deluge operations) to manage personnel risks and impacts was up to 20 days.*

6.2.1.1 Safety Case Considerations

Woodside has assessed against the NOPSEMA safety case guidance (NOPSEMA N-09000-GN1161), confirming that vessels conducting subsea intervention operations are not classified as an “associated offshore place” but as a facility and therefore require the appropriate Safety Case arrangements to be in place. In the event of an emergency, Woodside has access to suitable vessels (ISVs) for well intervention through existing frame agreements. The frame agreements for ISV vessels require the vessels to maintain in-force safety case approval covering a range of subsea activities. This would cover the requirement for intervention operations such as subsea manifold installation, maintenance and repair, commissioning, cargo transfer (including bulk liquids) and ROV operations. With frame agreements in place, the credible Safety Case Scenario from those presented in **Figure 6-3** for implementing this response would be “no safety case revision required”. Timeframes for well intervention are detailed in **Figure 6-2** and would be implemented concurrently to the actions required by the “no Safety Case” revision scenario detailed in **Figure 6-3**, therefore, the Safety Case scenario will have no impact on the delivery of the strategy.

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6.2.2 Debris clearance and/or removal

The Woodside Source Control Response Procedure details the mobilisation and resource requirements for implementing this strategy. Debris clearance may be required as a prerequisite to deployment of the capping stack. The AMOSC SFRT would be mobilised from Fremantle. The mobilisation of the SFRT would take place in parallel with mobilisation of the capping stack to ensure initial ROV surveys and debris clearance have commenced before the arrival of the capping stack. The SFRT comprises ROV-deployed cutters and tools that are used to remove damaged or redundant items from the wellhead and allow improved access to the well. The SFRT can be mobilised and deployed with well intervention attempted within 11 days.

6.2.2.1 Safety case considerations

Woodside has assessed against the NOPSEMA safety case guidance (NOPSEMA N-09000-GN1161) and can confirm that vessels conducting debris clearance and removal operations are not classified as an “associated offshore place” but as a facility and therefore require the appropriate Safety Case arrangements in place. In the event of an emergency, Woodside has access to suitable ISVs for these operations through existing frame agreements. The frame agreements for ISVs require the vessels to maintain in-force safety case approval covering a range of subsea activities. This would cover the requirement for debris clearance and removal operations such as subsea manifold installation, commissioning, cargo transfer (including bulk liquids) and ROV operations. With frame agreements in place, the credible Safety Case Scenario, from those presented in **Figure 6-3** for implementing this response would be “no safety case revision required”. Timeframes for debris clearance and removal equipment deployment are detailed in **Figure 6-2** and would be implemented concurrently to the actions required by the “No Safety Case” revision scenario detailed in **Figure 6-3**, therefore, the Safety Case scenario will have no impact on the delivery of the strategy.

6.2.3 Capping stack

The Woodside Source Control Response Procedure details the mobilisation and resource requirements for implementing this strategy. A capping stack is designed to be installed on a subsea well and provides a temporary means of sealing the well, until a permanent well kill can be performed through either a relief well or well re-entry.

In the event of loss of well containment, if environmental conditions permit (wind speed, wave height, current and plume conditions), deployment and landing of a capping stack on the BOP can be accommodated with a safety factor greater than 1. The wellhead strength and fatigue assessment confirm the conductor has sufficient axial capacity to support nominal plug and abandonment loads and contingency loads. The assessment is applicable to all Balnaves wells.

Woodside assumes that sourcing conventional capping stack deployment vessels would be per the Source Control Response Procedure. This plan has pre-identified vessel specifications for the capping stack deployment and Woodside monitors the availability and location of these vessels on a monthly basis. Woodside maintain several frame agreements with various vessel service providers and maintains the ability to call off services with a capping stack and debris clearance agreement. The location of suitable vessels for capping stack deployment are monitored monthly. The supply arrangements and reliability to achieve the required mobilisation time will be revalidated prior to undertaking this activity. Consideration to mobilise the capping stack from the supplier on a suitable vessel but then hand over to another vessel to conduct the capping activity will also be made to meet response time frames.

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A capping stack will be mobilised to site within 16 days. Woodside will monitor the conditions around the wellsite and deployment for well intervention attempt will be undertaken once safety and metocean conditions are suitable.

6.2.3.1 Safety Case Considerations

Woodside has assessed against the NOPSEMA safety case guidance (NOPSEMA N-09000-GN1661) and can confirm that vessels conducting capping stack are not classified as an “associated offshore place” but as a facility and therefore require the appropriate Safety Case arrangements in place.

The 16-day timeframe to mobilise the vessel is based on the following assumptions:

- existing frame agreement vessel, located outside the region with approved Australian Safety Case
- a safety case revision and scope of validation is required
- vessel that meets the technical requirements for deploying capping stack as per the Source Control Emergency Response Plan (SCERP).
- vessel has an active heave compensated crane, rated to at least 120 T and at least 90 m in length and a deck capacity to hold at least 110 T of capping stack.

Timeframes for capping stack deployment detailed in **Figure 6-2** would be implemented concurrently with the actions required for the Safety Case revision development scenarios detailed in **Figure 6-3** and **Table 6-3**. Woodside will execute the capping stack response in the fastest possible timeframe, provided the required safety, plume and metocean conditions allow. Woodside has considered a broad range of alternate, additional, and improved options as outlined later in **Section 6.2.5**.

6.2.4 Relief well drilling

The options analysis detailed in this section considers options to source, contract and mobilise a MODU and ensure necessary regulatory approvals are in place to meet timelines for relief well drilling. The screening for relief well drilling MODUs is based on the following:

- Primary – review internal Woodside drilling programs and MODU availability to source an appropriate rig operating within Australia with an approved Safety Case.
- Alternate – source and contract a MODU through APPEA MOU that is operating within Australia with an approved Safety Case.
- Contingency – source and contract a MODU outside Australia with an approved Australian Safety Case.

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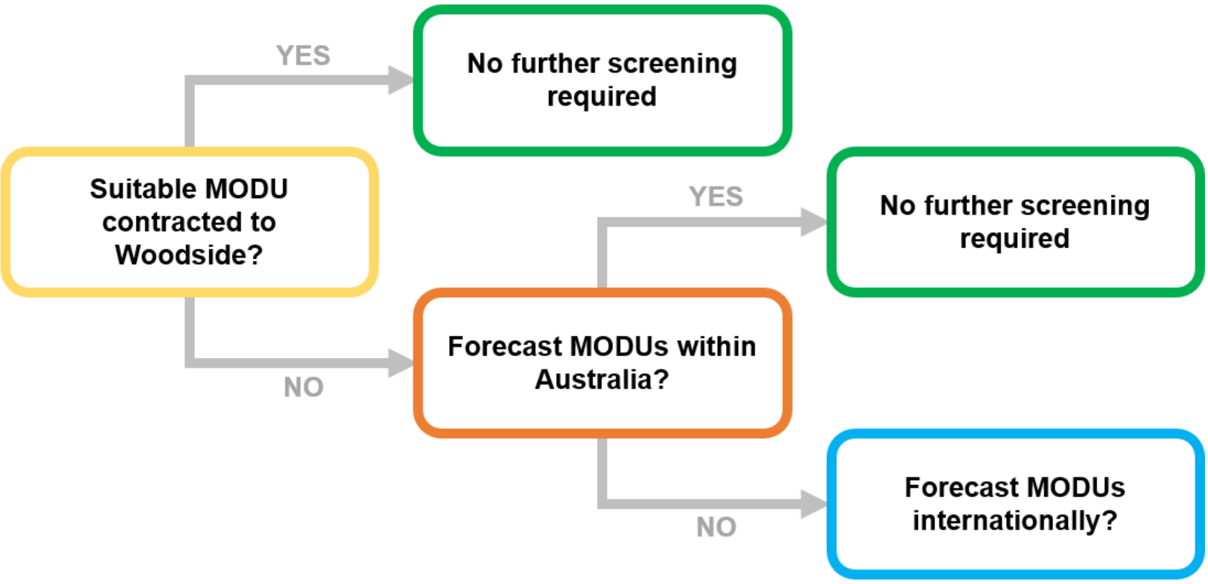

Figure 6-1: Balnaves process for sourcing relief well MODU

Woodside has not assessed the timeframe for obtaining a relief well MODU through international supply for this project as the certainty of local supply has been confirmed. Screening of a relief well MODU from international waters is undertaken only if required, i.e. there is low confidence in local (Australian) availability. The capability, location and Australian Safety Case status is assessed for each Woodside contracted MODU. In the event the Woodside contracted MODUs are unsuitable, screening is extended to all MODUs operating in Australian Waters. The suitability and location of pre-identified relief well MODUs is tested again prior to and during the operation. Though the APPEA MoU will serve as the instrument to facilitate the transfer of drilling units and well site services between operators in the event of an emergency, Woodside will engage each of the identified titleholders in advance to maintain confidence in MODU suitability and availability.

Based on the detail provided, the Primary and Alternate approaches are expected to be achieved within the 67-day period.

The detail of these arrangements demonstrates that the risks have been reduced to ALARP and Acceptable levels through the control measures and performance standards outlined in **Section** □.

6.2.4.1 Relief well drilling timings

The duration of a blowout (from initiation to a successful kill) is assessed as 67 days for the Balnaves PAP. Relief wells for other wells within the field are expected to be similar duration.

Details on the steps and time required to drill a relief well is shown in **Table 6-2** below. A dynamically positioned (DP) MODU will be used in the event that one is available and within a shorter range/ response time than a moored MODU, however, DP MODUs are not readily available in Australia and thus the predictions for moored MODUs in the table are the most likely scenario during a real event.

On a monthly basis, Woodside tracks and assesses the suitability of available MODUs internally and externally, plus MODU activities of registered operators and MODUs with approved safety cases. MODUs expected to be stationed in Australia for the duration of project are identified as part of the Relief Well Peer review conducted during the planning phase and immediately prior to spud.

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The ability to meet MODU mobilisation of 21 days is screened based on where the pre-identified MODUs will be stationed. For this project, suitable MODUs based in Australia have been identified by Woodside and thus there is a high level of confidence that the stated 21-day timeframe can be met.

To validate the effectiveness of the relief MODU supply arrangements through the APPEA MoU, the 21-day mobilisation period was tested in April 2019 in an exercise facilitated by an external party. This exercise included suspension of the assisting operator's activities, contracting the MODU, vessel safety case revision and transit to location. The testing of mobilisation arrangements has been incorporated into Woodside's Hydrocarbon Spill Arrangements Testing Schedule.

Table 6-2: Relief well drilling timings

	Estimate Relief Well duration for Balnaves Well (days) – moored
Source and contract MODU comprising the following stages:	**21 days total:**
Activate MOU.	*8 days*
Secure and suspend well.	
Complete relief well design.	
Secure relief well materials.	
Transit to location based on mobilisation from Northwest shelf region.	*2 days*
Backload and loadout bulks and equipment.	*2 days*
Complete internal assurance of relief well design.	
Contingency for unforeseen event e.g. longer transit from another area of Australia, problems in securing well, cyclone event.	*9 days*
Pre-spud survey	**Already included – concurrent with MODU mobilisation above**
Mooring Spread Installation *NB Occurs in parallel with the 21 days to mobilise the rig, so the timing included here is the difference.*	**4 days**
Drilling, casing and test BOP estimate	**28 days**
Intersection and well kill comprising the following stages: • *Drill out shoe, conduct formation integrity test and drill towards intersection point.* • *Execute well-specific ranging plan to intersect blowout wellbore in minimum timeframe, with highest possible accuracy.* • *Pump kill weight drilling fluid per the relief well plan. Confirm the well is static with no further flow.* • *Contingency for unforeseen technical issues (e.g. more ranging runs required to make intersect, additional mud circulations required to execute kill).*	**14 days**
	67 days

The following conditions and assumptions are applicable:

- The 21-day mobilisation time assumes a local MODU is available in Australia with other operator and regulatory approvals do not delay the spud date.

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- A dynamically positioned MODU is not available.
- A pre-lay mooring spread is required to moor the rig over subsea infrastructure. Mobilisation would occur in parallel to MODU mobilisation.

Whilst Woodside will make every endeavour to accelerate these activities to reduce the pre-lay mooring timeframe, Woodside believes they are sufficiently conservative to ensure these activities can be completed. Woodside has considered a broad range of alternate, additional, and improved options as outlined in **Section 6.2.5**.

Intersect and kill duration is estimated at 14 days. This is a moderately conservative estimate. During the intersect process, the relief well will be incrementally drilled and logged to accurately approach and locate the existing well bore. This will result in the highest probability of intersecting the well on the first attempt and thus will reduce the overall time to kill the well. During the Montara incident, it took five attempts to achieve a successful intersect.

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Figure 6-2: Source control and well intervention response strategy deployment timeframes

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6.2.4.2 Safety case considerations

Woodside recognises that it will not be the Operator or holder of the Safety Case for the MODU and/or vessels involved in relief well activities. In the event that a revision to the Operator's Safety Case is required for relief well drilling, Woodside has identified measures to ensure timely response and optimise preparedness as far as practicable that can be undertaken to expedite a straightforward Safety Case revision for a MODU/ vessel to commence drilling a relief well. Performance standards associated with these measures have been included in **Section □**.

These include;

- Access to Safety and Risk discipline personnel with specialist knowledge.
- Monitoring internal and external rigs and vessel availability in region and extended area through contracted arrangements on a monthly basis.
- Prioritisation of rigs/vessels with current or historical contracting arrangements. Woodside maintains records of previous contracting arrangements and companies. All current contracts for vessels and rigs are required to support Woodside in the event of an emergency.
- Leverage mutual aid arrangements such as the APPEA MOU for vessel and rig support.
- Woodside Planning and Logistics, and Safety Officers (on-Roster/Call 24/7) which can articulate need for, and deliver Woodside support, in key delivery tasks including sitting with potential outside operators.
- Ongoing strategic industry engagement and collaboration with NOPSEMA to work toward time reductions in regulatory approvals for emergency events.

Woodside has identified three safety case revision development and submission scenarios for a MODU and plotted these alongside the relief well preparation activities in **Figure 6-3**. The assumptions for each of the cases are detailed in subsequent **Table 6-3**.

The MODUs screened for contingency relief well drilling all operate under an accepted base Safety Case. A relief well Safety Case Revision would leverage the previously accepted Safety Case Revision for the Balnaves PAP, including the associated site-specific well hazards. As such, there is less new detail for the regulator to review and should present a short review timeframe with no impact expected to the commencement of relief well drilling activities.

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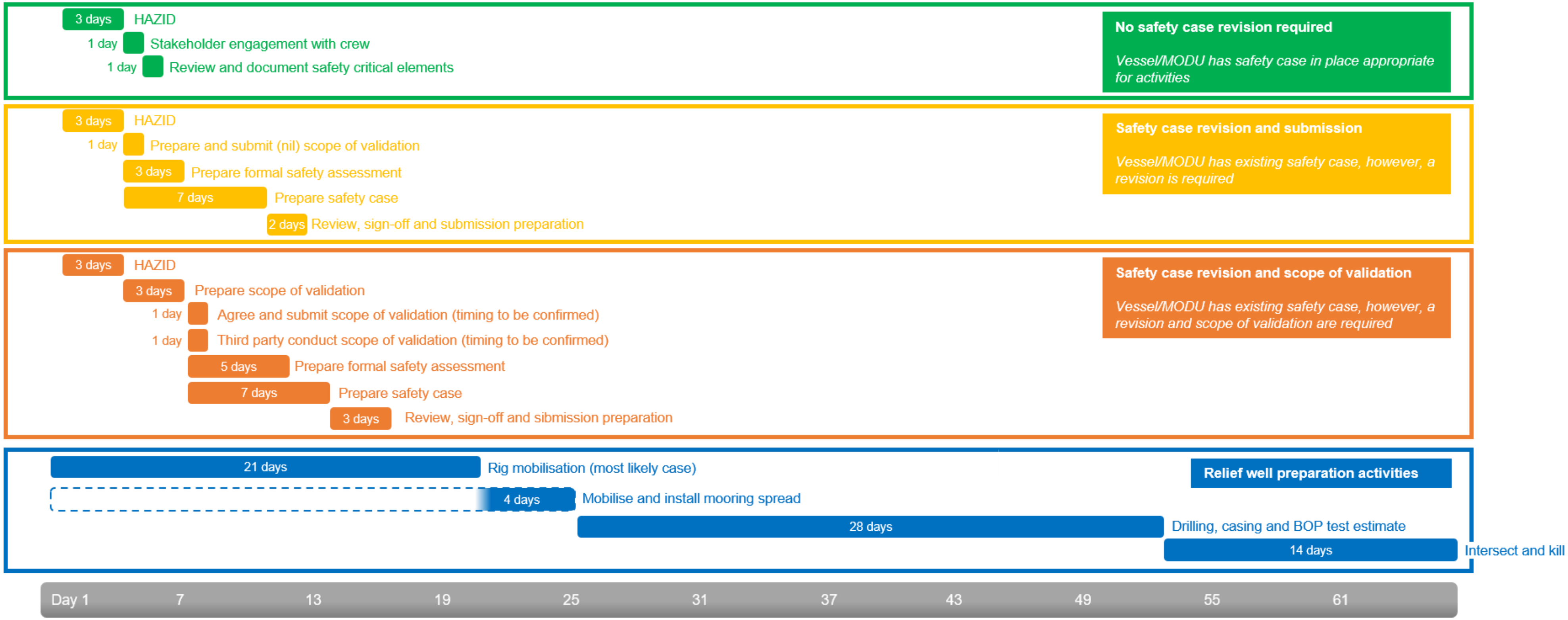

Figure 6-3: Timeline showing safety case revision timings alongside other relief well preparation activity timings

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Table 6-3: Safety case revision conditions and assumptions

Case	**No safety case revision required**	**Safety case revision and submission**	**Safety case revision and scope of validation**
Description	Vessel/MODU has a safety case in place appropriate for activities.	Vessel/MODU has an existing safety case, however, a revision is required.	Vessel/MODU has an existing safety case, however, a revision is required plus scope of validation.
Conditions/ assumptions	Assumes that existing vessel/MODU safety case covers working under the same conditions or the loss of containment is not severe enough to result in any risk on the sea surface.	Safety case timing assumes vessel/MODU selected and crew and available for workshops and safety case studies.	Safety case timing assumes vessel/ MODU selected and crew and available for workshops and safety case studies.
		Assumes nil scope of validation. This assumes that the vessel for SSDI allows for working in a hydrocarbon environment and control measures are already in place in the existing safety case. For MODU, it assumes that the relief well equipment is already part of the MODU facility and MODU safety case.	Validation will be required for new facilities only. The time needed for the validator to complete the review (from the last document received) and prepare validation statement is undetermined. This is not accounted for here as the safety case submission is not dependent on the validation statement, however the safety case acceptance is.
		Assumes safety case preparation is undertaken 24/7.	Assumes safety case preparation is undertaken 24/7.

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6.2.5 Source Control – Control Measure Options Analysis

The assessments described in **Section 6.2**, **Section 6.2.2** and **Section 6.2.4** outline the primary and alternate approaches that Woodside would implement for source control.

Woodside has outlined the options considered against the activation/mobilisation (alternative, additional and improved options), deployment (additional and improved options) process described in **Section 2.1.1** that provides an evaluation of:

- predicted cost associated with adopting the option
- predicted change/environmental benefit
- predicted effectiveness/feasibility of the option.

Alternative, Additional and Improved options have been identified and assessed against the base capability described in **Section 5.2** 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.

- Alternative options, including potentially more effective and/or novel control measures are evaluated as replacements for an adopted control.
- Additional control measures are evaluated in terms of their ability to reduce an impact or risk when added to the existing suite of control measures.
- 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.

Options where there is not a clear justification for their inclusion or exclusion may be subject to a detailed assessment.

6.2.5.1 Activation/Mobilisation Options Considered

Alternative

- Standby MODU shared for all Woodside activities
- Standby MODU shared across APPEA MOU Titleholders

Additional

- Implement and maintain minimum standards for Safety Case development

Improved

- Monitor internal drilling programs for rig availability
- Monitor external activity for rig availability
- Monitor status of Registered Operators/ Approved Safety cases for rigs

6.2.5.2 Deployment Options Considered

Additional

- Pre-drilling top-holes
- Purchase and maintain mooring system
- Contract in place with WWCI and Oceaneering

Improved

- Maintaining relief well drilling supplies (mud, casing, etc).

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6.2.6 Activation/Mobilisation – Control Measure Options Analysis

This section details the assessment of alternative, additional or improved control measures that were considered to ensure the selected level of performance in **Section 5.2** reduces the risk to ALARP. The Alternative, Additional and Improved control measures that have been assessed and selected are highlighted in green and the relevant performance of the selected control is cross referenced. Items highlighted in red have been considered and rejected on the basis that they are not feasible or the costs are clearly disproportionate compared to the environmental benefit.

6.2.6.1 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	**Feasibility**	**Environmental benefits/impacts**	**Approximate cost**	**Assessment conclusions**	**Implemented**
Standby MODU shared for all Woodside activities	A standby MODU shared across all Woodside activities is likely to provide a moderate environmental benefit as it may reduce the 21-day sourcing, contracting and mobilisation time by up to 10 days (to 11 days). This would reduce the volume and duration of release and may reduce impacts on receptors and sensitivities. This may allow the well to be killed up to 10 days sooner (total of 57 days for well kill) and may result in a reduction of up to 1978 m^3 of Balnaves Crude for the worst-case credible scenario.	This option is not considered feasible for all Woodside activities as there are a large range of well depths, complexities, geologies and geophysical properties across all Woodside's operations. The large geographic area of Woodside activities also means that the MODU is unlikely to be in the correct location at the right time when required.	Even with costs shared across Woodside operations, the costs (approximately A$219 m per annum, A$1.95 b over the five years) of maintaining a shared MODU are considered disproportionate to the environmental benefit potentially achieved by reducing mobilisation times by up to 10 days.	The costs and complexity of having a MODU and maintaining this arrangement for the duration of the Petroleum Activities Program are disproportionate to the environmental benefit gained above finding a MODU through the MOU agreement for all spill scenarios.	No
Standby MODU shared across APPEA MOU Titleholders	A standby MODU shared across all titleholders who are signatories to the APPEA MOU is likely to provide a minor environmental benefit as it may reduce the 21-day sourcing, contracting and mobilisation time by up to seven days (to 14 days). This would reduce the volume and duration of release and may reduce impacts on receptors and sensitivities. This may result in a reduction of up to 2,769 m^3 of Balnaves Crude for the worst-case credible scenario.	This option is not considered feasible for a number of Titleholders due to the remote distances in Australia as well as a substantial range of well depths, types, complexities, geologies and geophysical properties across a range of Titleholders	As the environmental benefit is only considered minor and the reduction in timing would only be for the mobilisation period (reduction from 21 days to 14 days) the costs are considered disproportionate to the minor benefit gained.	The costs and complexity of having a MODU and maintaining a shared arrangement for the duration of the Petroleum Activities Program are disproportionate to the environmental benefit gained above finding a MODU through the MOU agreement for all spill scenarios.	No

6.2.6.2 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	**Feasibility**	**Environmental benefits/impacts**	**Approximate cost**	**Assessment conclusions**	**Implemented**
Implement and maintain minimum standards for Safety Case development	Woodside's contingency planning consideration would be to source a rig from outside Australia with an existing Safety Case. This would require development and approval of a safety case revision for the rig and activities prior to commencing well kill operations.	This option is considered feasible and would require Woodside to develop minimum standards for safe operations for relevant Safety Case input along with maintaining key resources to support review of Safety Cases. Woodside would not be the operator for relief well drilling and would therefore not develop or submit the Safety Case revision. Woodside's role as Titleholder would be to provide minimum standard for safe operations that MODU operators would be required to meet and/or exceed.	Woodside has outlined control measures and performance standards regarding template Safety Case documentation and maintenance of resources and capability for expedited Safety Case review.	This option has been selected based on its feasibility, low cost and the potential environmental benefits it would provide.	Yes

6.2.6.3 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	Feasibility	Environmental benefits/impacts	Approximate cost	Assessment conclusions	Implemented
Monitor internal drilling programs for rig availability	Woodside may be conducting other campaigns that overlap with the Petroleum Activities Program, potentially providing availability of a relief well drilling rig within Woodside. The environmental benefit of monitoring other drilling programs internally is for Woodside to understand what other rigs may be rapidly available for relief well operations if required, potentially reducing the time to drill the relief well, resulting in less hydrocarbon to the environment.	Woodside monitors vessel and MODU availability through market intelligence services for location. Woodside will continually monitor other drilling and exploration activities within Australia and as available throughout the region to track rigs and explore rig availability during well intervention operations.	Associated cost of implementation is minimal to the environmental benefit gained. Woodside has outlined control measures and performance standards.	This option is a low-cost control measure with potential to reduce the volume of hydrocarbon released to the environment.	Yes
Monitor external activity for rig availability	The environmental benefit achieved by monitoring drilling programs and rig movements across industry provides the potential for increased availability of suitable rigs for relief well drilling. Additional discussions with other Petroleum Titleholders may be undertaken to potentially gain faster access to a rig and reduce the time taken to kill the well and therefore volume of hydrocarbons released.	Woodside will source a relief well drilling rig in accordance with the APPEA MOU on rig sharing in the unlikely event this is required. Commercial and operational provisions do not allow Woodside to discuss current and potential drilling programs in detail with other Petroleum Titleholders.	Associated cost of implementation is moderate to the environmental benefit gained. Woodside will continually engage with other Titleholders and Operators regarding activities within Australia and as available throughout the region to track rigs and explore rig availability during well intervention operations.	This option is a low-cost control measure with potential to reduce the volume of hydrocarbon released to the environment.	Yes
Monitor status of Registered Operators / Approved Safety cases for rigs	Woodside can monitor the status of Registered Operators for rigs operating within Australia (and therefore safety case status) on a monthly basis. This allows for a prioritised selection of rigs in the event of a response with priority given to those with an existing safety case.	The environmental benefit of monitoring rigs is for Woodside to understand what other rigs may be rapidly available for relief well operations if required, potentially reducing the time to drill the relief well, resulting in less hydrocarbon to the environment.	The cost is minimal.	This option is a low-cost control measure with potential to reduce the volume of hydrocarbon released to the environment.	Yes

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6.2.7 Deployment – Control Measure Options Analysis

6.2.7.1 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	Assessment conclusions	Implemented
Pre-drilling top-holes	This option represents additional environmental impacts associated with discharge of additional drill cuttings and fluids along with benthic habitat disturbance. It is also not expected to result in a significant decrease in relief well timings.	This option is not considered feasible due to the uncertainties related to the location and trajectory of the intervention well, which may vary according to the actual conditions at the time the loss of containment event occurs. Additionally, there is only expected to be a minor reduction in timing for this option of 1-2 days based on the drilling schedule. Duration to drill and kill may be reduced by 1-2 days, but top-hole may have to be relocated, due to location being unsafe or unsuitable and further works will be required each year to maintain the top holes.	Utilising an existing MODU and pre-drilling top-hole for relief well commencement would significantly increase costs associated the Petroleum Activities Program. Estimated cost over the program's life is approx. A$555,000 per day over the PAP based on 2-4 days of top-hole drilling (plus standby time) for the 18 wells as the worst-case scenarios.	This option would not provide an environmental benefit due to the additional environmental impacts coupled with a lack of improved relief well timings.	No
Purchase and maintain mooring system	Purchasing and maintaining a mooring system could provide a moderate environmental benefit as it may reduce equipment sourcing time. However, due to the continued need for specialists to install the equipment plus sourcing a suitable vessel, the timeframe reduction would be minimal.	Woodside is not a specialist in installing and maintaining moorings so would require specialists to come in to install the moorings and would also require specialist vessels to be sourced to undertake the work.	The cost of purchasing, storing and maintaining pre-lay mooring systems with anchors, chains, buoys and ancillary equipment is considered disproportionate to the environmental benefit gained.	This option would not provide an environmental benefit as timeframe reductions would be minimal.	No
Contract in place with Wild Well Control and Oceaneering	Woodside has an agreement in place with Wild Well Control Inc and Oceaneering to provide trained personnel in the event of an incident. This will ensure that competent personnel are available in the shortest possible timeframe.	Having contracts in place to access trained, competent personnel in the event of an incident would reduce mobilization times. This option is considered reasonably practicable.	Minimal cost implications – Woodside has standing contract in place to provide assistance across all activities.	This control measure is adopted as the costs and complexity are considered proportionate to any environmental benefit that might be realised.	Yes

6.2.7.2 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	Assessment conclusions	Implemented
Maintaining relief well drilling supplies	There is not predicted to be any reduction in relief well timing or spill duration from Woodside maintaining stocks of drilling supplies (mud, casing, cement, etc.)	It would be feasible to source some relief well drilling supplies such as casing but the actual composition of the cement and mud required will need to be specific to the well. This option is also not deemed necessary as the lead time for sourcing and mobilising these supplies is included in the 21 days for sourcing and mobilising a rig.	The capital cost of Woodside purchasing relevant drilling supplies is expected to be approximately A$600,000 with additional costs for storage and ongoing costs for replenishment. These costs are considered disproportionate to the environmental benefit gained.	This option would not provide an environmental benefit.	No

6.2.8 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
    - Implement and maintain minimum standards for Safety Case development

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  - Contract in place with Wild Well Control and Oceaneering to supply trained, competent personnel
- Improved
  - Monitor internal drilling programs for MODU availability
  - Monitor external activity for MODU availability
  - Monitor status of Registered Operators / Approved Safety cases for MODUs

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6.3 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 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 Source Control via Vessel SOPEP – Control Measure Options Analysis

6.3.1.1 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

6.3.1.2 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

6.3.1.3 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

6.3.2 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

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6.4 Shoreline Clean-up – 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 – Shoreline Clean-up

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-fueling/re-stocking provisions, and other similar logistic and operational limitation that are beyond Woodside's direct control.

6.4.2 Response planning: Balnaves P&A – Shoreline Clean-up

Woodside has assessed existing capability against the WCCS and has identified that the range of techniques provide an ongoing approach to shoreline clean-up at identified RPAs.

Shoreline accumulation greater than the 100 g/m^2 threshold is not predicted to occur at any location and surface hydrocarbons at concentrations equal to or greater than 1 g/m^2 are also not predicted to contact any shoreline. As noted in **Section 5.3**, the optimum shoreline accumulation that triggers clean-up activities is 250 g/m^2 with 100 g/m^2 triggering shoreline surveys. The shoreline accumulations predicted by the modelling for CS-01 (15 – 51 g/m^2) are significantly lower than the thresholds that would normally trigger shoreline surveys or clean-up. Therefore, it is unlikely that shoreline accumulations will be practicable to clean-up and may not be visible. However, subject to operational monitoring, shoreline clean-up has been maintained as a potential response option, should concentrations of accumulated residual hydrocarbons be identified on shorelines and a clean-up response is feasible.

The shortest predicted timeframe that shoreline accumulation (greater than 10 g/m^2) is 8.3 days at Barrow Island (2 m^3) and the Montebello Islands (3 m^3), with shoreline accumulation peaking with an additional 8 m^3 in total in Weeks 3 and 4, and an additional 5 m^3 between Weeks 5 and 10. Should shoreline clean-up be considered feasible, Woodside's existing shoreline clean-up capability would be sufficient.

Shoreline clean-up may not be as time critical compared to other response techniques (e.g. source control, monitor and evaluate) and the scale will depend on the success of other techniques (e.g. source control) preventing oiling occurring. Further, the potential scale and remoteness of a response coupled with the uncertainty of which locations will be affected precludes the stockpiling or prepositioning of equipment specific to shorelines. The most significant constraint is accommodation and transport of personnel in the Exmouth region to undertake clean-up operations and to manage wastes generated during the response effort. From previous assessment of facilities in the Exmouth region, Woodside estimates that current accommodation can cater for a range of 500-700 personnel per day.

Woodside has identified several options which could be mobilised to achieve defined response objectives. Evaluation considers the benefit in terms of the time to respond and the scale of response made possible by each option. The evaluation of possible alternative, additional and improved control measures is summarised in **Section 6.4.3.**

Table 6-4: Response Planning – Shoreline Clean-up

	Shoreline clean-up (Phase 2)	**Day**	**Day**	**Day**	**Day**	**Day**	**Day**	**Day**		**Week**	**Week**	**Week**		**Month**	**Month**	**Month**	**Month**
		1	**2**	**3**	**4**	**5**	**6**	**7**		**2**	**3**	**4**		**2**	**3**	**4**	**5**
	Oil on shoreline (from spill modelling) m^3																
	Shoreline accumulation (above 100 g/m^2) - m^3	0	0	0	0	0	0	0		0	0	0		0	0	0	0
	Oil remaining following response operations - m^3	0	0	0	0	0	0	0		0	0	0		0	0	0	0
A	**Capability Required (number of operations)**																
A1	**Shoreline clean-up operations required (lower)**	0	0	0	0	0	0	0		0	0	0		0	0	0	0
A2	**Shoreline clean-up operations required (upper)**	0	0	0	0	0	0	0		0	0	0		0	0	0	0
B	**Capability Available (number of operations)**																
B1	**Shoreline clean-up operations available - Stage 2 - Manual (lower)**	0	1	3	5	8	12	15		105	105	105		560	560	560	560
B2	**Shoreline clean-up operations available - Stage 2 - Manual (upper)**	0	2	5	8	10	15	20		140	140	140		560	560	560	560
C	**Capability Gap**																
C1	**Shoreline clean-up operations gap (lower)**	0	0	0	0	0	0	0		0	0	0		0	0	0	0
C2	**Shoreline clean-up operations gap (upper)**	0	0	0	0	0	0	0		0	0	0		0	0	0	0

A1 and A2 – the number of Shoreline Clean-up operations required based on the hydrocarbon volumes ashore above 100 g/m^2
B1 and B2 – the upper and lower number of shoreline clean-up operations available (based on response planning assumptions in ***Section 5.3****),*
C1 and C2 – the gap between the upper and lower number of shoreline clean-up operations required in A1 and A2 compared to the operations available in B1 and B2

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Table 6-5: RPAs for Balnaves P&A

Areas of coastline contacted	Conservation status	IUCN protection category	Credible Scenario-01		Credible Scenario-05	
			Minimum time to shoreline contact (above 10 g/m^2) in days	Maximum shoreline accumulation (above 10 g/m^2) in m^3	Minimum time to shoreline contact (above 10 g/m^2) in days	Maximum shoreline accumulation (above 10 g/m^2) in m^3
Ningaloo Coast 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	24.8 days	6 m^3	No shoreline contact above threshold predicted	No shoreline contact above threshold predicted
Muiron Islands State Marine Park	Muiron Islands Marine Management Area	IUCN VI - Multiple Use Zone	20.1 days	2 m^3	No shoreline contact above threshold predicted	No shoreline contact above threshold predicted
Montebello Islands	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	8.3 days	3 m^3	No shoreline contact above threshold predicted	No shoreline contact above threshold predicted
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	8.3 days	2 m^3	No shoreline contact above threshold predicted	No shoreline contact above threshold predicted
Southern Pilbara – Islands	N/A	N/A	30.5 days	<1 m^3	No shoreline contact above threshold predicted	No shoreline contact above threshold predicted

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6.4.3 Shoreline Clean-up – Control measure options analysis

6.4.3.1 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.					

6.4.3.2 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 trained personnel available	The level of training and competency of the response personnel ensures the shoreline clean-up operation is delivered with minimum secondary impact to the environment.	Additional personnel required to sustain an extended response can be sourced through the Woodside *People & Global Capability Surge Labour Requirement Plan*. Additional personnel could be sourced from contracted OSROs (OSRL/AMOSC) to manage other responders. Response personnel are trained and exercised regularly in shoreline response techniques and methods. All personnel involved in a response will receive a full operational/safety brief prior to commencing operations.	Additional Specialist Personnel would cost A$2000 per person per day.	This option would be adopted if real time operational monitoring determines that an impact is likely above the existing response capability.	Yes
Additional trained personnel deployed	Maintaining a span of control of 200 competent personnel is deemed manageable and appropriate for this activity. Additional personnel conducting clean-up activities may be able to complete the clean-up in a shorter timeframe, but modelling predicts ongoing stranding of hydrocarbons over a period of weeks. Managing a smaller, targeted response is expected to achieve an environmental benefit through ensuring the shoreline clean-up response is suitable and scalable for the shoreline substrate and sensitivity type. This will ensure there is no increased impact from the shoreline clean-up through the presence of unnecessary personnel and equipment.	The figure of 200 personnel is broken down to include on 1-2 x Trained Supervisors managing 8-10 personnel/labour hire responders. This allows for multiple operational teams to operate along the extended shoreline at different locations. Typically, an additional 30-50% of the tactical workforce is required to support ongoing operations including On-Scene control, logistics, safety/medical/welfare and transport. Personnel on site will include members with the appropriate specialties to ensure an efficient shoreline clean-up. Additional personnel are available through existing contracts with oil spill response organisations, labour hire organisations and environmental panel contractors	Additional Specialist Personnel would cost $2,000 per person per day.	This option is not adopted as the existing capability meets the need.	No

6.4.3.3 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/ mobilisation time	Hydrocarbons are predicted to strand after a period of approximately 8 days therefore allowing enough time to re-locate existing equipment, personnel and other resources to the most appropriate areas.	Response teams, trained personnel, contracted oil spill response service providers, government agencies and the associated mitigation equipment required to enact an initial protection and deflection response will be available for mobilisation within 48 hours of activation. Woodside already maintains an equipment stockpile in Exmouth to enable shorter response times to incidents. This stockpile includes temporary waste storage equipment.	The cost of establishing a local stockpile of new shoreline clean-up equipment closer to the expected hydrocarbon stranding areas is not commensurate with the need.	This option is not adopted as the existing capability meets the need.	No

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		Woodside has access to stockpiles of waste storage and equipment in Dampier and Exmouth through existing contracts and arrangements. RPAs predicted to be contacted are based on modelling and may differ in a real spill event thus pre-positioning equipment and personnel may provide no additional benefit.			

6.4.4 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
  - Additional trained personnel available (if need is determined by real-time operational monitoring during a spill event).
- Improved
  - None selected

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6.5 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.

6.5.1 Existing Capability – Wildlife Response

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, refuelling/re-stocking provisions, and other similar logistic and operational limitation that are beyond Woodside's direct control.

6.5.2 Oiled Wildlife Response – Control Measure Options Analysis

6.5.2.1 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. 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

6.5.2.2 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. Provides 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. These 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.	Given the low likelihood of such an event occurring and the low environmental benefit of an offshore response, the cost of implementing measures to reduce the mobilisation time is considered disproportionate to the benefit. 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. Oiled wildlife response capacity would be addressed for open Commonwealth waters through the AMOSC arrangements, as informed by operational monitoring. The cost and organisational complexity of this approach is moderate, and the overall delivery effectiveness is high.	Additional wildlife response resources could total A$1700 per operational site per day.	This option is not adopted as the existing capability meets the need.	No
Additional trained wildlife responders	Current numbers meet the needs required and additional personnel are 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 provides the capacity to treat approximately 600 wildlife units (primarily avian wildlife) by Day 6, with additional capacity available from OSRL. Additional equipment and facilities would be required to support ongoing response, depending on the scale of the event and the impact to wildlife. Materials for holding facilities, portable pools, enclosures and rehabilitation areas would be sourced as required.	Additional wildlife response personnel cost A$2000 per person per day	This option is not adopted as the existing capability meets the need.	No

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6.5.2.3 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 for expected first shoreline contact. This control measure provides increased effectiveness through faster mobilisation of specialists. However, no significant net environmental benefit is expected due to shoreline stranding times.	Pre-positioning vessels or equipment would reduce mobilisation time for oiled wildlife response activities. However, RPAs predicted to be contacted are based on modelling data and may differ in a real spill event thus pre-positioning equipment and personnel may provide no additional benefit. The selected delivery options provide the capacity to mobilise an oiled wildlife response capable of treating up to 600 wildlife from at least Day 6 and exceeds the estimated Level 2-3 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 spill modelling cost A$700 per package per day. The cost of having dedicated equipment and personnel available to respond faster is, however, considered disproportionate to the environmental benefit.	This option is not adopted as the existing capability meets the need.	No

6.5.3 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

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6.6 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.

6.6.1 Existing Capability – Waste Management

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, refuelling/re-stocking provisions, and other similar logistic and operational limitation that are beyond Woodside's direct control.

6.6.2 Waste Management – Control Measure Options Analysis

6.6.2.1 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.					

6.6.2.2 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. A$1300 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

6.6.2.3 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 access to Veolia waste storage options provides the resources to store and transport waste, permitting the wastes to be stockpiled and gradually processed within the regional waste handling facilities. Bulk transport to Veolia's licensed waste management facilities would be undertaken via controlled-waste-licensed vehicles and in accordance with Environmental Protection (Controlled Waste) Regulations 2004. 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	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

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	time of the event is considered low and existing arrangements provide adequate storage to support the response.				🟥

6.6.3 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

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6.7 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.

6.7.1 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 limitation that are beyond Woodside's direct control.

6.7.2 Scientific Monitoring – Control Measure Options Analysis

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 over to the East coast. 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 Karratha to carry out the hydrocarbon analysis would provide faster turnaround in reporting of results only by a matter 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.

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 well control from the PAP activities.	As part of Woodside's Scientific Monitoring Program the following are considered and incorporated in the SMP Standby Service contract. i. Woodside rely 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 well control from the PAP activities based on receptors predicted to have hydrocarbon contact >10 days. ii. Ensure there is appropriate baseline for key receptors for all geographic locations that are potentially impacted <10 days of spill event. Address resourcing needs to collect pre-emptive baseline as the spill expands in the event of a loss of well control from the PAP activities.

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

Ref	Control Measure Category	Option considered	Implemented	Environmental Consideration	Feasibility / Cost
No reasonably practical alternative control measures identified.					

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6.7.3 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
  - Determine baseline data needs and activate SMPs for any identified PBAs in the event of an unplanned hydrocarbon release
- Improved
  - None selected.

6.7.4 Operational Plan

Key actions from the Scientific Monitoring Program Operational Plan for implementing the response are outlined in **Table 6-6**.

Table 6-6: Scientific monitoring program operational plan actions

Responsibility	Action
Activation	
Perth ICC Planning (ICC Planning – Environment Unit)	Mobilises 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 (**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 Lean/Manager and SMP Coordinator)	SMP co-ordinator stands up SMP Standby contractor. Stands up subject matter experts, if required.
Perth ICC Planning (ICC Planning – Environment Unit) (SMP Lead/Manager, SMP Coordinator, SMP Standby contractor)	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)	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 Lead/Manager, SMP Coordinator, SMP Standby 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. Update the IAP.
Perth ICC Planning (ICC Planning – Environment Unit)	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.

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Responsibility	Action
(SMP Lead/Manager, SMP Coordinator, SMP Standby contractor)	Engage with SMP standby contractor, 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 Scientific Monitoring Program 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 contractor)	Confirm communications procedures between Woodside SMP team, SMP standby contractor, 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 contractor 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).

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6.7.5 ALARP and Acceptability Summary

ALARP and Acceptability Summary		
Scientific Monitoring		
ALARP Summary		All known reasonably practicable control measures have been adopted
	X	Determine baseline data needs and activate SMPs for any identified PBAs in the event of an unplanned hydrocarbon release
		No reasonably practical additional, alternative, and/or improved control measure exists
	The resulting scientific monitoring capability has been assessed against the worst credible spill scenario, CS-01. The range of techniques 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.	
Acceptability Summary	• 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 well control. • The level of impact and risk to the environment has been considered with regards to the principles of 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 credible case scenarios, and uncertainty has not been used as a reason for postponing control measures.	
On the basis from the impact assessment above and in Section 7 of the Balnaves Plug and Abandonment 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.		

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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.

7.1.1 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
- Presence of personnel on the shoreline
- Human presence (manual cleaning)
- Vegetation cutting
- Additional stress or injury caused to wildlife
- Secondary contamination from the management of waste

7.1.2 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.

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Table 7-1: Analysis of risks and impacts

	Environmental Value						
	Soil and Groundwater	**Marine Sediment Quality**	**Water Quality**	**Air Quality**	**Ecosystems/ Habitat**	**Species**	**Socio-Economic**
Monitor and evaluate		✓	✓		✓	✓	
Source control		✓	✓	✓	✓	✓	✓
Oiled Wildlife					✓	✓	
Scientific Monitoring							
Waste Management	✓			✓	✓	✓	✓

7.1.3 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.

Drill cuttings and Drilling Fluids Environmental Impact Assessment for Relief Well Drilling

The identified potential impacts associated with the discharge of drill cuttings and fluids during a relief well drilling activity include a localised reduction in water and seabed sediment quality, and potential localised changes to benthic biota (habitats and communities).

A number of direct and indirect ecological impact pathways are identified for drill cuttings and drilling fluids as follows:

- Temporary increase in total suspended solids (TSS) in the water column;
- Attenuation of light penetration as an indirect consequence of the elevation of TSS and the rate of sedimentation;
- Sediment deposition to the seabed leading to the alteration of the physio-chemical composition of sediments, and burial and potential smothering effects to sessile benthic biota; and
- Potential contamination and toxicity effects to benthic and in-water biota from drilling fluids.

Potential impacts from the discharge of cuttings range from the complete burial of benthic biota in the immediate vicinity of the well site due to sediment deposition, smothering effects from raised sedimentation concentrations as a result of elevated Total Suspended Solids (TSS), changes to the physico-chemical properties of the seabed sediments (particle size distribution and potential for reduction in oxygen levels within the surface sediments due to organic matter degradation by aerobic bacteria) and subsequent changes to the composition of infauna communities to minor sediment loading above background and no associated ecological effects. Predicted impacts are generally confined to within a few hundred metres of

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the discharge point (International Association of Oil and Gas Producers 2016) (ie within the EMBA for a hydrocarbon spill event).

The discharge of drill cuttings and unrecoverable fluids from relief well drilling is expected to increase turbidity and TSS levels in the water column, leading to an increased sedimentation rate above ambient levels associated with the settlement of suspended sediment particles in close proximity to the seabed or below sea surface, depending on location of discharge. Cuttings with retained (unrecoverable) drilling fluids are discharged below the water line at the MODU location, resulting in drill cuttings and drilling fluids rapidly diluting, as they disperse and settle through the water column. The dispersion and fate of the cuttings is determined by particle size and density of the retained (unrecoverable) drilling fluids, therefore, the sediment particles will primarily settle in proximity to the well locations with potential for localised spread downstream (depending on the speed of currents throughout the water column and seabed) (IOGP 2016). The finer particles will remain in suspension and will be transported further before settling on the seabed.

These conclusions were supported by discharge modelling which was undertaken by Woodside in support of the Greater Enfield Development Environment Plan. Modelling results indicating that the TSS plume of suspended cuttings will typically disperse to the south-west while oscillating with the tide and diminish rapidly with increasing distance from the well locations. Maximum TSS concentrations predicted for 100 m; 250 m and 1 km distances from the wellsite were 7, 5 and 1 mg/L, respectively. Furthermore, water column concentrations below 10 mg/L remain within 235 m of the discharge location for each modelled well. For all well discharge locations (outside of direct discharge sites), TSS concentration did not exceed 10 mg/L. Nelson et al. (2016) identified <10 mg/L as a no effect or sub-lethal minimal effect concentration.

The low sensitivity of the deep-water benthic communities/habitats within and in the vicinity of relief well locations, combined with the relatively low toxicity of WBM and NWBMs, no bulk discharges of NWBM and the highly localised nature and scale of predicted physical impacts to seabed biota indicate that any localised impact would likely be of a slight magnitude (especially when considering the broader consequence of the LOC event a relief well drilling activity would be responding too).

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 shoreline clean-up operations
- Semi-solids/solids (oily solids), collected during shoreline clean-up operations
- Debris (e.g. seaweed, sand, woods, plastics), collected during shoreline clean-up operations and 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.

Cutting back vegetation could allow additional oil to penetrate the substrate and may also lead to localised habitat loss. However, any loss is expected to be localised in nature and lead to an overall net environmental benefit associated with the response by reducing exposure of wildlife to oiling.

Additional stress or injury caused to wildlife

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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.

7.1.4 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, Tactical Response Plans, and/or First Strike Response Plans.

Vessel operations and access in the nearshore environment

- If vessels are required for access, anchoring locations will be selected to minimise disturbance to benthic primary producer 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 (PS 15.1).
- Shallow draft vessels will be used to access remote shorelines to minimise the impacts associated with seabed disturbance on approach to the shorelines (PS 15.2)

Presence of personnel on the shoreline

- Oversight by trained personnel who are aware of the risks (PS 15.6)
- Trained unit leaders brief personnel of the risks prior to operations (PS 15.7)

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 8.1, 15.5)
- Vehicular access will be restricted on dunes, turtle nesting beaches and in mangroves (PS 15.3)

Waste generation

- Zoning of response locations to prevent secondary contamination and minimize the mixing of clean and oiled sediment and shoreline substrates (PS 13.4)
- Limiting vegetation removal to only that vegetation that has been moderately or heavily oiled (PS 15.4)

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Additional stress or injury caused to wildlife

- Operations conducted with advice from the DBCA Oiled Wildlife Advisor and in accordance with the processes and methodologies described in the WA OWRP and the relevant regional plan (PS 17.3)

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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 have 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 all other scenario from this activity.
- The likelihood of the WCCS spill has been ignored in evaluating what was reasonably practicable.

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9 ACCEPTABILITY CONCLUSION

Following the ALARP evaluation process, Woodside deems the hydrocarbon spill risks and impacts 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 AND 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, e.g., [location].

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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 Oil Pollution Emergency Arrangements (Australia) 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. These are defined as: surface hydrocarbon concentration – ≥10 g/m^2, dissolved – ≥100 ppb and entrained hydrocarbon concentrations – ≥500 ppb.
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.

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11.2 Abbreviations

Abbreviation	Meaning
ADIOS	Automated Data Inquiry for Oil Spills
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 ASA
BAOAC	Bonn Agreement Oil Appearance Code
BOP	Blowout Preventer
C&R	Containment and Recovery
cSt	Centistokes
CICC	Corporate Incident Coordination Centre
DM	Duty Manager
DoT	Western Australia Department of Transport
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	Emergency Shut Down
ESP	Environmental Services Panel
FPSO	Floating Production Storage Offloading
FSP	First Strike Response Plan
GIS	Geographic Information System
GPS	Global Positioning System
HSP	Hydrocarbon Spill Preparedness
IAP	Incident Action Plan
ICC	Incident Coordination Centre
IMT	Incident Management Team
IPIECA	International Petroleum Industry Environment Conservation Association
ITOPF	International Tanker Owners Pollution Federation
IUCN	International Union for Conservation of Nature
KBSF	King Bay Supply Facility
KICC	Karratha Incident Coordination Centre
KSAT	Kongsberg Satellite
ME	Monitor and Evaluate

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Abbreviation	Meaning
MODU	Mobile Offshore Drilling Unit
MoU	Memorandum of Understanding
NEBA	Net Environmental Benefit Analysis
NOAA	National Oceanic and Atmospheric Administration
NRT	National Response Team
OILMAP	Oil Spill Model and Response System
OPEA	Oil Pollution Emergency Arrangements
OPEP	Oil Pollution Emergency Plan
OPGGSA	Offshore Petroleum and Greenhouse Gas Storage Act
OSMP	Operational and Scientific Monitoring Program
OSRL	Oil Spill Response Limited
OSTM	Oil Spill Trajectory Modelling
OWR	Oiled Wildlife Response
OWRP	Oiled Wildlife Response Plan
OWROP	Regional Oiled Wildlife Response Operational Plan
PAP	Petroleum Activities Program
PEARLS	People, Environment, Asset, Reputation, Livelihood and Services
PBA	Pre-emptive Baseline Areas
PPA	Priority Protection Area
PPB	Parts per billion
PPM	Parts per million
ROV	Remotely Operated Vehicle(s)
RPA	Response Protection Area
SCAT	Shoreline Contamination Assessment Techniques
SCERP	Source Control Emergency Response Plan
SDA	Surface Dispersant Application
SHC	Shoreline Clean-up
SIMAP	Integrated Oil Spill Impact Model System
SSDI	Subsea Dispersant Injection
SFRT	Subsea First Response Toolkit
SMP	Scientific monitoring program
SOP	Standard Operating Procedure
TRP	Tactical Response Plan
WHA	World Heritage Area
Woodside	Woodside Energy Limited
WCC	Woodside Communication Centre
WWCI	Wild Well Control Inc
WCCS	Worst Case Credible Scenario
ZoA	Zone of Application

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ANNEX A: NET ENVIRONMENTAL BENEFIT ANALYSIS DETAILED OUTCOMES

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A NEBA has been conducted to assess the net environmental benefit of different response techniques to selected receptors in the event of an oil spill from the PAP for a subsea loss of well containment of Balnaves Crude (Credible Scenario-01) and a surface hydrocarbon release due to a support vessel tank rupture of marine diesel (Credible Scenario-05). The complete list of potential receptor locations within the EMBA within the PAP is included in Section 6 of the EP.

The locations utilised for the NEBA were limited to the identified RPAs of the PAP identified from modelling (see Section 3 for outline of selection).

These include receptors which have potential for the following:

- Surface contact (>50 g/m^2) at any time;
- Shoreline accumulation (100 g/m^2) at any time;
- Entrained contact (>100 ppb) prior to day 14

The full NEBA assessment outcomes are available via this Link

Table A-1: NEBA assessment technique recommendations for Balnaves crude – Balnaves P&A loss of well containment (Credible Scenario-01)

Receptor	Monitor and Evaluate	Containment and Recovery	Dispersant application: sub-sea	Dispersant application: > 20 m water depth and > 10 km from shore/reefs	Shoreline protection	Shoreline clean-up (manual)	Shoreline clean-up (mechanical)	Shoreline clean-up (chemical)	Oiled Wildlife Response	In situ burning	Mechanical dispersion	Source Control
Open Ocean - Commonwealth Waters (Operational Area)	Yes	No	No	No	No	No	No	No	Yes	No	No	Yes
Rankin Bank	Yes	No	No	No	No	No	No	No	Potentially	No	No	N/A
Poivre Reef	Yes	No	No	No	No	No	No	No	Potentially	No	No	N/A
Tryal Rocks	Yes	No	No	No	No	No	No	No	Potentially	No	No	N/A
Rosily Shoals	Yes	No	No	No	No	No	No	No	Potentially	No	No	N/A
Montebello AMP	Yes	No	No	No	No	No	No	No	Potentially	No	No	N/A
Montebello Shoals	Yes	No	No	No	No	No	No	No	Potentially	No	No	N/A
Montebello Islands (incl. State MP)	Yes	No	No	No	No	Potentially	No	No	Potentially	No	No	N/A
Barrow Island (incl. State MP and MMA)	Yes	No	No	No	No	Potentially	No	No	Potentially	No	No	N/A
Southern Pilbara Islands	Yes	No	No	No	No	Potentially	No	No	Potentially	No	No	N/A
Muiron Islands	Yes	No	No	No	No	Potentially	No	No	Potentially	No	No	N/A
Boodie Island	Yes	No	No	No	No	Potentially	No	No	Potentially	No	No	N/A

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Overall assessment

	Monitor and Evaluate	Containment and Recovery	Dispersant application: sub-sea	Dispersant application: > 20 m water depth and > 10 km from shore/reefs	Shoreline protection	Shoreline clean-up (manual)	Shoreline clean-up (mechanical)	Shoreline clean-up (chemical)	Oiled Wildlife Response	In situ burning	Mechanical dispersion	Source Control
Is this response Practicable?	**Yes**	**No**	**No**	**No**	**No**	**Potentially**	**No**	**No**	**Yes**	**No**	**No**	**Yes**
NEBA identifies Response potentially of Net Environmental Benefit?	**Yes**	**No**	**No**	**No**	**No**	**Potentially**	**No**	**No**	**Yes**	**No**	**No**	**Yes**

Note: No shoreline locations are predicted to be impacted above the 100 g/m^2 threshold. However, some shoreline locations are predicted to receive lower shoreline accumulations (15 - 51 g/m^2), and these shoreline locations have been considered for completing the NEBA and to support response planning. Therefore, shoreline clean-up has been maintained as a potential response option, subject to operational monitoring confirming shoreline accumulation at concentrations where a clean-up response is feasible.

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Table A-2: NEBA assessment technique recommendations for surface hydrocarbon release due to a support vessel tank rupture of marine diesel (Credible Scenario-05)

Receptor	Monitor and Evaluate	Containment and Recovery	Dispersant application: sub-sea	Dispersant application: > 20 m water depth and > 10 km from shore/reefs	Shoreline protection	Shoreline clean-up (manual)	Shoreline clean-up (mechanical)	Shoreline clean-up (chemical)	Oiled Wildlife Response	In situ burning	Mechanical dispersion	Source Control
Open Ocean - Commonwealth Waters (Operational Area)	Yes	No	No	No	No	No	No	No	Yes	No	No	Yes
Montebello AMP	Yes	No	No	No	No	No	No	No	Yes			No
Rankin Bank	Yes	No	No	No	No	No	No	No	Potentially			No
Gascoyne AMP	Yes	No	No	No	No	No	No	No	Potentially			No
Ningaloo Coast Middle (Incl. WHA)	Yes	No	No	No	No	No	No	No	Potentially			No
Ningaloo AMP (RUZ)	Yes	No	No	No	No	No	No	No	Potentially			No
Ningaloo Coast North WHA	Yes	No	No	No	No	No	No	No	Potentially			No

Overall assessment

	Monitor and Evaluate	Containment and Recovery	Dispersant application: sub-sea	Dispersant application: > 20 m water depth and > 10 km from shore/reefs	Shoreline protection	Shoreline clean-up (manual)	Shoreline clean-up (mechanical)	Shoreline clean-up (chemical)	Oiled Wildlife Response	In situ burning	Mechanical dispersion	Source Control
Is this response Practicable?	Yes	No	No	No	No	No	No	No	Yes	No	No	Yes
NEBA identifies Response potentially of Net Environmental Benefit?	Yes	No	No	No	No	No	No	No	Yes	No	No	Yes

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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.

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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 • Response activities have ceased • Hydrocarbon spill modelling (as verified by OM02 surveillance observations) predicts no additional natural resources will be impacted

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Operational Monitoring **Operational Plan**	Objectives	Activation triggers	Termination criteria
Operational Monitoring Operational Plan 2 (OM02) 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
Operational Monitoring Operational Plan 3 (OM03) 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 (2000) trigger values for 99% species protection.

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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.	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)

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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 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 fauna 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.

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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 SMP Standby 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 SMP Standby 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.

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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 SMP Lead/Manager 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.

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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).

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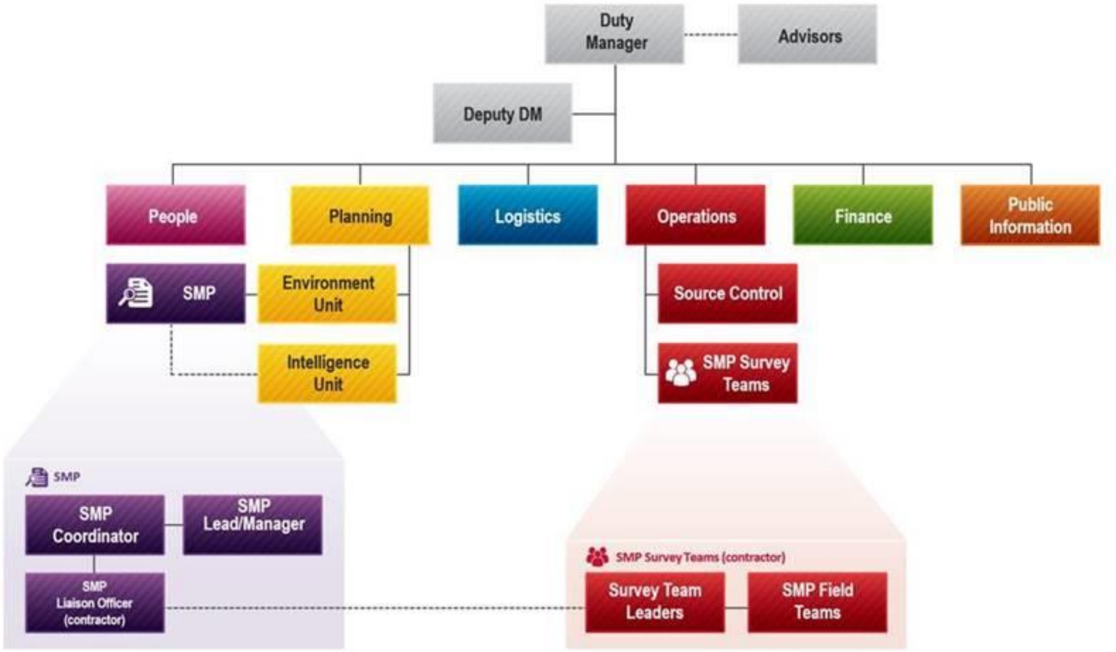

Figure C-1: Woodside Oil Spill Scientific Monitoring Program Delivery Team and Linkage to Incident Control Centre (ICC) organisational structure.

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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[6]) 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/m² surface, 5 ppb for entrained/dissolved hydrocarbons and ≥1 g/m² 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[7]) 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/m² surface, 5 ppb for entrained/dissolved hydrocarbons and ≥1 g/m² 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 • 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.	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.

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[6] NOPSEMA (2019) Bulletin #1 – Oil spill modelling – April 2019, https://www.nopsema.gov.au/assets/Bulletins/A652993.pdf

[7] 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.

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Scientific monitoring Program (SMP)	Objectives	Activation Triggers	Termination Criteria
		- Operational monitoring identified shoreline potential contact of hydrocarbons (at or above 0.5 g/m² surface, 5 ppb for entrained/dissolved hydrocarbons and ≥1 g/m² 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/m² surface, 5 ppb for entrained/dissolved hydrocarbons and ≥1 g/m² 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/m² surface, 5 ppb for entrained/dissolved hydrocarbons and ≥1 g/m² 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/m² surface, ≥5 ppb for entrained/dissolved hydrocarbons and ≥1 g/m² 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.

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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/m² 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.

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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), CMRs, 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 (Link).

The starting point for decision-making on what SMPs are activated and 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, CMRs 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 (Link)) 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 (Link). 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), CMRs, 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**).

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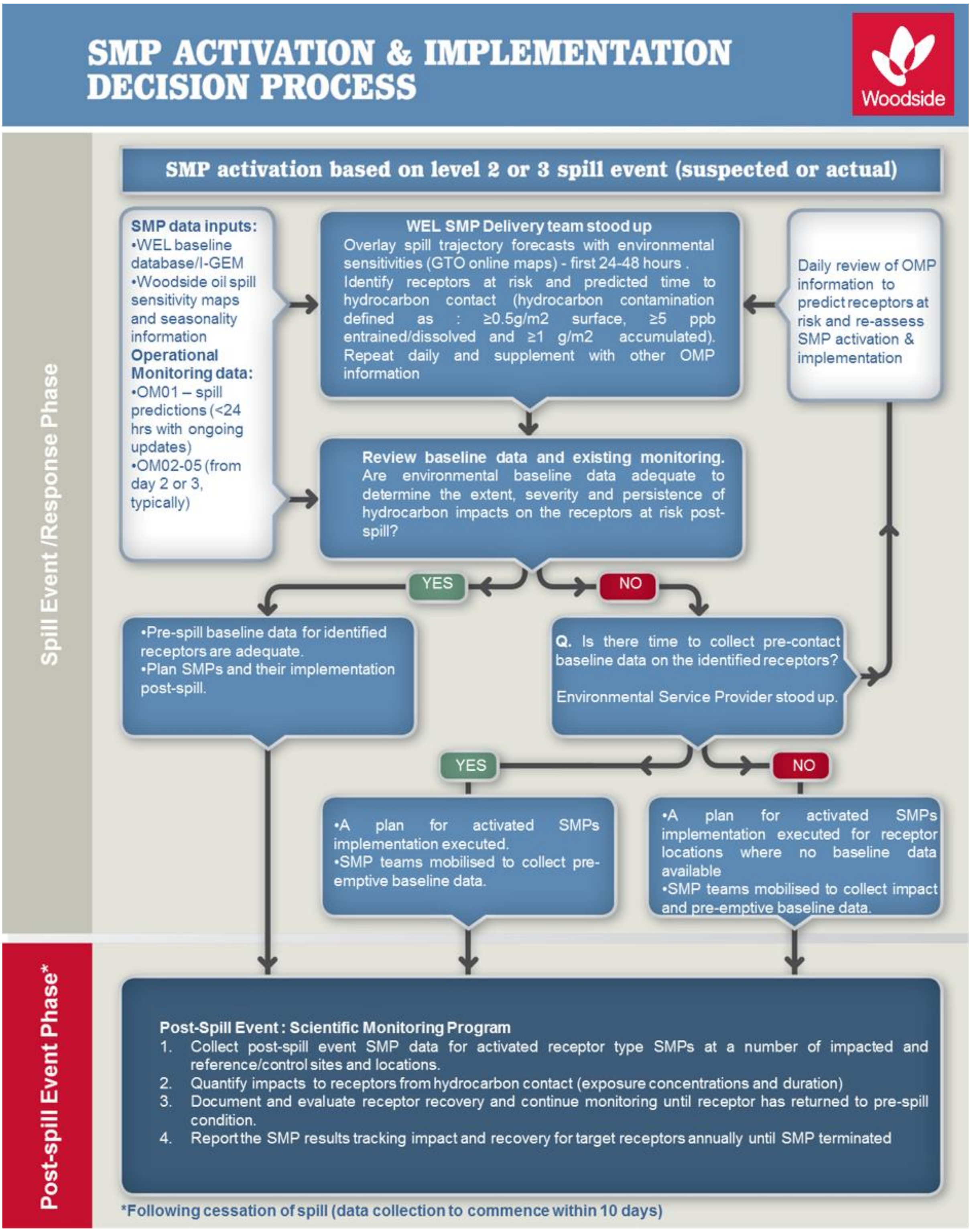

SMP activation based on level 2 or 3 spill event (suspected or actual)

SMP data inputs:
- WEL baseline database/I-GEM
- Woodside oil spill sensitivity maps and seasonality information

Operational Monitoring data:
- OM01 – spill predictions (<24 hrs with ongoing updates)
- OM02-05 (from day 2 or 3, typically)

WEL SMP Delivery team stood up
Overlay spill trajectory forecasts with environmental sensitivities (GTO online maps) - first 24-48 hours . Identify receptors at risk and predicted time to hydrocarbon contact (hydrocarbon contamination defined as : ≥0.5g/m2 surface, ≥5 ppb entrained/dissolved and ≥1 g/m2 accumulated). Repeat daily and supplement with other OMP information

Daily review of OMP information to predict receptors at risk and re-assess SMP activation & implementation

Review baseline data and existing monitoring. Are environmental baseline data adequate to determine the extent, severity and persistence of hydrocarbon impacts on the receptors at risk post-spill?

- Pre-spill baseline data for identified receptors are adequate.
- Plan SMPs and their implementation post-spill.

Q. Is there time to collect pre-contact baseline data on the identified receptors?

Environmental Service Provider stood up.

- A plan for activated SMPs implementation executed.
- SMP teams mobilised to collect pre-emptive baseline data.

- A plan for activated SMPs implementation executed for receptor locations where no baseline data available
- SMP teams mobilised to collect impact and pre-emptive baseline data.

Post-Spill Event : Scientific Monitoring Program
1. Collect post-spill event SMP data for activated receptor type SMPs at a number of impacted and reference/control sites and locations.
2. Quantify impacts to receptors from hydrocarbon contact (exposure concentrations and duration)
3. Document and evaluate receptor recovery and continue monitoring until receptor has returned to pre-spill condition.
4. Report the SMP results tracking impact and recovery for target receptors annually until SMP terminated

*Following cessation of spill (data collection to commence within 10 days)

Figure C-2: Activation and Implementation Decision-tree for Oil Spill Environmental Monitoring

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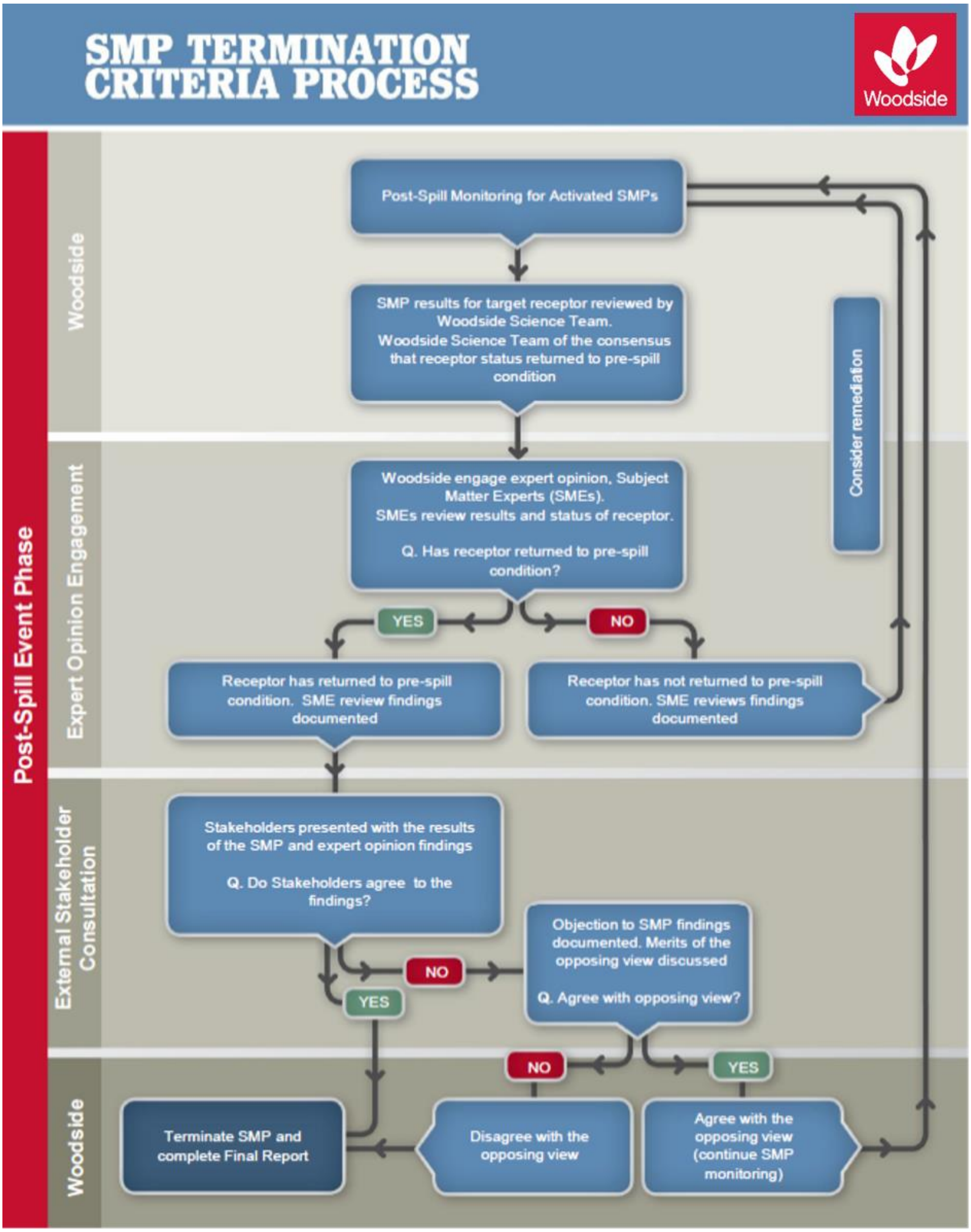

Figure C-3: Termination Criteria Decision-tree for Oil Spill Environmental Monitoring

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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 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. IGEM held data were integrated into the Department of Water and Environmental Regulation (WA) Index of Marine Surveys for Assessment (IMSA)[8] in 2020. The Index of Marine Surveys for Assessments (IMSA) is an online portal for information about marine-based environmental surveys in Western Australia. IMSA is a project of the Department of Water and Environmental Regulation (the department) for the systematic capture and sharing of marine data created as part of an environmental impact assessment (EIA).

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, IMSA 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.

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[8] https://biocollect.ala.org.au/imsa#max%3D20%26sort%3DdateCreatedSort

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ANNEX D: MONITORING PROGRAM AND BASELINE STUDIES FOR THE PETROLEUM ACTIVITIES PROGRAM

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Table D-1: Oil Spill Environmental Monitoring – scientific monitoring program scope for the Petroleum Activities Program based on Spill EMBA based on the worst case credible scenario-01

Receptors to be Monitored		Receptor Areas - Potential Impact and Reference Scientific Monitoring Sites (marked X)																																							
	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	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	SM01	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	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	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	X	X	X	X	X	X	X	X	X			X	X	X	X	X	X	X	
Seagrass / Macro-Algae	SM03	X									X					X	X	X									X	X	X	X	X	X	X	X	X	X	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	X	X	X						X							X			
Mangroves and Saltmarsh	SM04																											X						X	X	X	X	X		X	
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					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						X	X	X	X	X	X	X	X	X	X	X	X	X	X	
Pinnipeds (significant colonies / haul-out sites)	SM07									X	X	X			X																										X
Cetaceans - Migratory Whales	SM08	X	X	X	X		X	X	X	X	X	X	X	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	X	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Dugongs	SM08	X							X							X												X	X	X	X	X	X		X	X	X	X	X	X	
Sea Snakes	SM08	X		X	X			X	X	X						X	X	X	X	X	X	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X	
Whale Sharks	SM08			X			X	X										X										X	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	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	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	X	X	X			X	X	X		X	X	X	X	X	X	X	X	X	X
Fisheries - Traditional	SM10															X	X	X									X													X	
Tourism (incl. recreational fishing)	SM10	X		X			X	X	X		X			X	X	X	X	X	X	X	X	X	X	X				X	X	X	X	X	X	X	X	X	X	X	X	X	X

🟧	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)
▨	Receptor areas identified as Pre-Emptive Baseline Areas in the response phase >10 days (based on criteria of surface contact and/or entrained hydrocarbon contact >10 days)
☐	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

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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 & Glomar Shoal	Montebello Islands	Barrow Island	Lowendal Islands	Pilbara Islands – Southern Island Group (Serrurier, Thevenard and Bessieres Islands – State Nature Reserve)	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.	1. Broad benthic habitat classifications and habitat maps for the Montebello islands by DBCA. 2. Coral monitoring at sites across Barrow Island, Lowendal and the Montebello islands. Most recent survey 2012. 3. Benthic community monitoring as part of DBCA Western Australian Marine Monitoring Program (2015-ongoing). 4. Pilbara Marine Conservation Partnership Seabed biodiversity survey (2013).	1. Chevron LTM of corals for the Gorgon Gas Development. Marine Baseline Program (2008), Marine Monitoring Program (2010) Post Development Surveys (2011 – 2013). 2.Coral monitoring at sites around Barrow Island, Lowendal and the Montebello islands. Most recent survey 2012. 3.Benthic community (coral, seagrass and macroalgae) monitoring as part of DBCA's Western Australian Marine Monitoring Program (2015-ongoing). 4.Pilbara Marine Conservation Partnership Seabed biodiversity survey (2013).	1. Benthic habitats surrounding the Lowendal Islands for the Gorgon Gas Development. Coral assemblages on the eastern side of Double Island, and coral bommies on the south-western edge of the Lowendal Shelf. 2. Coral monitoring at sites across Barrow Island, Lowendal and the Montebello islands. Most recent survey 2012. 3. Pilbara Marine Conservation Partnership Seabed biodiversity survey (2013).	1. Benthic habitat mapping of the subtidal and intertidal habitats of the islands and shoals. Coral communities in shallow subtidal habitat, intertidal pavement. 2. Coral monitoring at Varanus and Airlie Islands (2000 to present) to identify corals, growth from and percentage cover 3. Pilbara Marine Conservation Partnership Seabed biodiversity survey (2013; 2016)	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. Habitat mapping. 2. Quantitative assessment details not available. 3. Drop camera. 4. Fixed long-term monitoring sites. Diver video transect. 5. Towed video, benthic trawl and sled.	1. Belt transect, size class frequency, video transects, photo quadrat, tagged colonies and terracotta tiles for coral recruitment. 2. Quantitative assessment 3. Fixed long-term monitoring sites. Diver video transects. 4. Towed camera, benthic trawl and sled.	Benthic habitat mapping, diver swum transects, tagged colonies. Quantitative assessment Towed video, benthic trawl and sled.	1. ROV transects. 2. ROV transects and driver surveys 3. Towed video, benthic trawl and sled	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. DBCA 2007. DATAHOLDER: DBCA. 2. RPS, 2012. DATAHOLDER: Santos. 3. DATAHOLDER: DBCA. 4. Pitcher et al. (2016). DATAHOLDER: CSIRO.	1. Baseline: Chevron Australia 2010. Marine Monitoring Program: Chevron Australia 2011 Post Dredge: Chevron Australia 2013 DATAHOLDER: Chevron Australia. 2. RPS, 2012. DATAHOLDER: Santos. 3. Bancroft 2009. DATAHOLDER: DoEE. 4. Pitcher et al. (2016). DATAHOLDER: CSIRO.	1. RPS-Bowman Bishaw Gorham 2005. DATAHOLDER: Chevron. 2. RPS, 2012. DATAHOLDER: Santos. 3. Pitcher et al. (2016). DATAHOLDER: CSIRO.	1. Chevron 2010. DATAHOLDER: Chevron. 2. Quadrant Energy/Santos 2016 DATAHOLDER: Santos 3. CSIRO (2013; 2016). Roland Pitcher. DATAHOLDER	1. Advisian 2019 2. Keesing 2019 3. McLean et al. 2019
	SM03	**Studies:**					

Major Baseline	Proposed Scientific monitoring operational plan and Methodology	Rankin Bank & Glomar Shoal	Montebello Islands	Barrow Island	Lowendal Islands	Pilbara Islands – Southern Island Group (Serrurier, Thevenard and Bessieres Islands – State Nature Reserve)	Montebello AMP
Benthic Habitat (Seagrass and Macro-algae)	Quantitative assessment using image capture using either diver held camera or towed video. Post analysis into broad groups based on taxonomy and morphology.	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. Santos, macroalgae monitoring at sites across Lowendal and the Montebello islands in 2012. 2. Pilbara Marine Conservation Partnership Seabed biodiversity survey (2013).	1. Chevron LTM of Seagrass and Macro algae habitats for the Gorgon Gas Development project. Marine baseline Program (2008, 2009), Marine Monitoring Program (2010), Post Dredge Survey one (2011) 2. Chevron study by RPS in 2004 on Barrow Island intertidal zone. 3. Pilbara Marine Conservation Partnership Seabed biodiversity survey (2013).	1. Benthic habitats including seagrass and macroalgae for the (Lowendal Islands, Chevron Janz Feed Gas Pipeline Project.) Gorgon Gas Development Project. 2. Santos macroalgae monitoring at sites across Lowendal and the Montebello islands in 2012. 3. Pilbara Marine Conservation Partnership Seabed biodiversity survey (2013).	1. Benthic habitat mapping of the subtidal and intertidal habitats of the islands and shoals. Algae communities in shallow subtidal habitat, intertidal pavement. 3. Pilbara Marine Conservation Partnership Seabed biodiversity survey (2013; 2016)	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	1. Quantitative assessment details not available. 2. Towed video, benthic trawl and sled.	1. Diver transects, photo quadrats, biomass. 2. Physical observational survey of intertidal habitats on Barrow Island. 3. Towed video, benthic trawl and sled.	1. Diver Transects, Photo Quadrats. 2. Quantitative assessment details not available. 3. Towed video, benthic trawl and sled.	1. ROV transects. 2. Towed video, benthic trawl and sled	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	1. RPS 2012. DATAHOLDER: Santos. 2. Pitcher et al. (2016). DATAHOLDER: CSIRO.	1. Baseline: Chevron Australia 2010. Marine Monitoring Program: Chevron Australia 2011 Post Dredge: Chevron Australia 2013 DATAHOLDER: Chevron Australia. 2. RPS-Bowman Bishaw Gorham 2005. DATAHOLDER: Chevron Australia. 3. Pitcher et al. (2016). DATAHOLDER: CSIRO.	1. RPS-Bowman Bishaw Gorham 2005. DATAHOLDER: Chevron. 2. RPS 2012. DATAHOLDER: Santos. 3. Pitcher et al. (2016). DATAHOLDER: CSIRO.	1. Chevron 2010. DATAHOLDER: Chevron 2. CSIRO (2013, 2016). Roland Pitcher. DATAHOLDER	N/A – see table D – 1
	SM03	**Studies:**					

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Major Baseline	Proposed Scientific monitoring operational plan and Methodology	Rankin Bank & Glomar Shoal	Montebello Islands	Barrow Island	Lowendal Islands	Pilbara Islands – Southern Island Group (Serrurier, Thevenard and Bessieres Islands – State Nature Reserve)	Montebello AMP
Benthic Habitat (Deeper Water Filter Feeders)	Quantitative assessment using image capture using towed video. Post analysis into broad groups based on taxonomy and morphology.	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	N/A – See Table D-1	N/A – See Table D-1	N/A – See **Table D-1**	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	N/A – See Table D-1	N/A – See Table D-1	N/A – See **Table D-1**	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	N/A – See Table D-1	N/A – See Table D-1	N/A – See **Table D-1**	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	1. Atmospheric correct and land cover classification, NW Cape. 2. Advanced Land Observing Satellite (ALOS) images taken in 2006, 2008, and 2010 by DBCA. Digital Aerial Photos were taken in 2009, and the area ground-truthed in 2006. 3. Ground truthing aerial photography to map the spatial extent of mangroves on the Montebello Islands. 4. Mangrove monitoring as part of DBCA Western Australian Marine Monitoring Program (ongoing).	1. Chevron LTM of Mangroves for the Gorgon Gas Development project. Marine Baseline Program (2009), Post Dredge Survey 1 (2011), Post Dredge Survey 2 (2013). 2. Baseline state of the mangroves 2008.	1. Atmospheric correct and land cover classification, NW Cape. 2. Santos Mangrove baseline (2010). 3. Santos - Long-term mangrove monitoring (1999-2011).	1. Study conducted by URS (November 2008 to May 2009) to ground truth aerial photography taken between 2001 and 2009 and to identify mangrove species present in the area.	N/A – see table D – 1

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Major Baseline	Proposed Scientific monitoring operational plan and Methodology	Rankin Bank & Glomar Shoal	Montebello Islands	Barrow Island	Lowendal Islands	Pilbara Islands – Southern Island Group (Serrurier, Thevenard and Bessieres Islands – State Nature Reserve)	Montebello AMP
		Methods:	Methods:				
		N/A – See Table D-1	1. Modular Inversion Program. May 2017 2. ALOS and Digital aerial photos, ground truthing, for Mangrove extent and mangrove relative canopy density. 3. Species Composition, LUX, canopy density. 4. Methods unknown.	1.Health scoring system, percentage cover, mean canopy density, qualitative health assessment. 2. Annual Mangrove composition, canopy density, pneumatophore density, leaf pathology, qualitative health.	1. Modular Inversion Program. May 2017 2.Aerial imagery (resolution of 0.2 m2 captured in 2010). 3. Qualitative data includes the presence of new growth, reproductive state, extent of defoliation and pneumatophore condition. Quantitative data, collected at the tree level, includes seedling density, stem diameter, number of defoliated branches and a number of canopy condition parameters.	1.Aerial Photography and Satellite imagery Species identification and community composition.	N/A – see table D – 1
		References and Data:					
		N/A – See Table D-1	1. EOMAP, 2017 DATAHOLDER: Woodside. 2.DBCA unpublished data. DATAHOLDER: DBCA. 2. Voga unpublish data DATAHOLDER: Voga Contact: [redacted] 3. DBCA. DATAHOLDER DBCA.	Baseline: Chevron Australia 2010. Marine Monitoring Program: Chevron Australia 2011 Post Dredge: Chevron Australia 2013 DATAHOLDER: Chevron Australia. Chevron 2014. DATAHOLDER: Chevron.	1. EOMAP, 2017 DATAHOLDER: Woodside. 2.Santos 2014. DATAHOLDER: Santos. 3. Santos 2011. DATAHOLDER: Santos.	1. URS (2010) DATAHOLDER: Chevron Australia	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	1.No recent studies. A DBCA/WAM study of terrestrial fauna of the islands was published in 2000 (Burbidge et al 2000). The most recent bird survey referenced in this review was 1998 by DBCA (DPaW, CALM).	1. Barrow Island migratory behaviour, nesting and foraging behaviour. 2. Migratory waders at Barrow Island. 3. LTM on Barrow island (island wide) Study September 2003 – 2006. 4. Chevron - Gorgon Gas Development. Terrestrial and subterranean environment monitoring program (2008-2015). Monitoring of Wedge-tailed Shearwaters, Bridled Terns, Silver Gulls.	1. Ongoing study of Bridled Terns from 2009. 2. Quadrant Energy seabird nesting on Lowendal Island, study 2013. 3. Lowendal Islands, common breeding bird species, structure, feeding and disturbances to the population. 4. Quadrant Energy/Santos – Integrated Shearwater Monitoring Program (1994-2016).	1. Migratory waterbirds relevant to the Wheatstone Project on behalf of URS in 2008 - 2009. 2. Quadrant Energy/Santos – Integrated Shearwater Monitoring Program (1994-2016). 3. Exmouth Sub-basin Avifauna Monitoring Program (2013-2014)	Present, in open water, no breeding habitat.
		Methods:					
		N/A – See Table D-1	1. Bird observations and counts.	1. Species, total numbers, Distribution, Roosting locations and foraging numbers. Migratory behaviour. 2. High tide roost counts, abundance counts. 3. Nest burrow density (number of burrows per m2); presence/absence of eggs or chicks in burrows; collapsed burrows and predation and mortality records. 4. Barrow Island: Variation in abundance and spatial/temporal distribution on beaches. Middle Island: Abundance; nest density; Presence and absence of eggs/chicks in nest.	1. Nest Density, presence and absence of chicks, predation and mortality counts. 2. Nest burrow density (number of burrows per m2); presence/absence of eggs or chicks in burrows. 3. Burrowscopes, Ultrasonic monitors to monitor burrows. 4. The distribution and abundance of other nesting seabirds within the Lowendal Island group, including up to 45 islands and islets, also occurred from 2004 onwards.	1. Ground counts, aerial surveys of wetlands by helicopter. 2. Burrow count and observation data, burrow density, colony stability, breeding participation, incubation effort and reproductive success has been determined. Tagging data 3. Aerial survevys and onshore island surveys.	N/A

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Major Baseline	Proposed Scientific monitoring operational plan and Methodology	Rankin Bank & Glomar Shoal	Montebello Islands	Barrow Island	Lowendal Islands	Pilbara Islands – Southern Island Group (Serrurier, Thevenard and Bessieres Islands – State Nature Reserve)	Montebello AMP
		References and Data:					
		N/A – See Table D-1	DBCA/WAM – Burbidge et al 2000.	1. Bamford M.J. & A.R 2004. DATAHOLDER: Chevron. 2. Bamford M.J & A.R 2011. DATAHOLDER: Chevron. 3. Chevron, 2013. DATAHOLDER: Chevron. 4. Chevron 2013. DATAHOLDER: Chevron.	1. Bamford M.J. & A.R 2004. DATAHOLDER: Chevron. 2. Surman 2012. DATAHOLDER: Santos. 3. Bamford M.J & A.R 2011. DATAHOLDER: Chevron. 4. DATAHOLDER: Santos.	1. Bamford, MJ & AR. 2011. DATAHOLDER: Chevron. 2. Quadrant Energy/Santos. Dataholders. Santos 3. Quadrant Energy/Santos. Dataholders. Santos	N/A
Turtles	**SM06** Beach surveys (recording species, nests, and false crawls).	**Studies:**					
		N/A – See Table D-1	1. LTM Study of Green, Flatback, Hawksbill turtles on beaches within the Barrow, Lowendal and Montebello Island Complex for Chevron. 2. Marine turtle monitoring as part of DBCA long-term turtle monitoring program (ongoing).	Chevron - Gorgon Gas Development. Long-term Turtle Monitoring Program - Flatback tagging program and marine turtle track census program (2005 – ongoing).	1. LTM Study of Green, Flatback, Hawksbill turtles on beaches within the Barrow, Lowendal and Montebello Island Complex. 2. Santos 2013 turtle nesting survey on the Lowendal islands. 3. Varanus Island Turtle monitoring program (2005 – present).	1. Baseline marine turtle surveys 2009 (included the islands of Serrurier, Bessieres and Thevenard), Pendoley (2009). 2. Exmouth Islands Turtle Monitoring Program (2013 and 2014) 3. North West Shelf Flatback Turtle Conservation Program's 4. Inter-nesting distribution of flatback turtles and industrial development in Western Australia (Thevenard Island)	Present, in open water, no nesting habitats.
		Methods:					
		N/A – See Table D-1	Nesting demographics (composition, spatial variability, seasonal distribution, post-nesting dispersion).	Island wide (though primary nesting occurs on east coast). Mundabullangana on mainland is the reference location for the Flatback tagging program.	1. Nesting demographics (composition, spatial variability, seasonal distribution, post-nesting dispersion). 2. Tagging and nest counts. 3. Tagging and nest counts. Varanus, Beacon, Bridled, Abutilon and Parakeelya islands.	1. Beach/Nesting surveys (counts by species). 2. Beach/Nesting surveys (counts by species). 3. Nesting and tagging studies 4. Satellite tracking methods	N/A
		References/Data:					
		N/A – See Table D-1	1. AMOSC/DPaW 2014. DATAHOLDER: Chevron. 2.DBCA.	Pendoley Environmental (2005-ongoing). DATAHOLDER: Chevron.	1. Pendoley 2005. AMOSC/DBCA (DPaW) 2014. DATAHOLDER: Chevron/ Santos. 2. Santos, 2014. DATAHOLDER: Santos. 3. Santos (2005 – present)	1. Pendoley 2009. DATAHOLDER: Chevron. 2. Quadrant Energy/Santos. Dataholders. Santos 3. DBCA. Dataholder 4. Pendoley Environment -Whittock, Pendoley and Hamann (2010-2011)	N/A
Fish	**SM09**	**Studies:**					

Major Baseline	Proposed Scientific monitoring operational plan and Methodology	Rankin Bank & Glomar Shoal	Montebello Islands	Barrow Island	Lowendal Islands	Pilbara Islands – Southern Island Group (Serrurier, Thevenard and Bessieres Islands – State Nature Reserve)	Montebello AMP
	Baited Remote Underwater Video Stations (BRUVS), Visual Underwater Counts (VUC), Diver Operated Video (DOV).	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. DBCA diver surveys 2009-2012. 2. Pilbara Marine Conservation Partnership Stereo BRUVS drops in shallow water (~8-20m) in 2014 and deeper (20-60m) in 2015 inside and outside sanctuary zones at the Montebello Islands and in the area from Cape Preston to the Montebello Islands in 2015. 3. Finfish monitoring as part of DBCA Western Australian Marine Monitoring Program (2015-ongoing).	1. Chevron LTM of demersal fish for the Gorgon Gas Development project. Marine Baseline Program (2008, 2009), Post Dredge Survey 1 (2011), Post Dredge Survey 2 (2012). 2. Pilbara Marine Conservation Partnership Stereo BRUVS drops in shallow water (~10m) from Exmouth to Barrow Islands in 2015. 3. Finfish monitoring as part of DBCAs Western Australian Marine Monitoring Program (2015-ongoing).	1. Pilbara Marine Conservation Partnership Stereo BRUVS drops in shallow water (~10m) Montebello Sanctuaries 2015. 2. WA Museum fish surveys of Dampier Archipelago 1998-2000 (Hutchins 2004).	1.Pilbara Marine Conservation Partnership Stereo BRUVS drops in deep water (20-55m) offshore of Bessieres Island in 2016.	1. CSIRO – Fish Diversity. 2. Fish species richness and abundance.
		Methods:					
		1. BRUVs. 2. BRUVs. 3. BRUVs. 4. BRUVs.	1. Diver Operated Video - species richness, community composition, and biomass were recorded from 2009-2012. 2. Stereo BRUVS. 3. Diver UVS.	1. Intertidal and subtidal surveys using BRUVS and Netting. 2. Stereo BRUVS. 3. Diver UVS.	1. Stereo BRUVS 2. Diver surveys _ Underwater Visual Census (UVC).	1. Stereo 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. DBCA data. DATAHOLDER: DBCA 2. CSIRO Data DATAHOLDER: CSIRO Data centre [redacted] 3. DBCA.	1. Baseline: Chevron Australia 2010. Marine Monitoring Program: Chevron Australia 2011. Post Dredge: Chevron Australia 2013 DATAHOLDER: Chevron Australia. 2. CSIRO Data DATAHOLDER: CSIRO Data centre [redacted] 3. DBCA.	1. UWA. The UWA Oceans Institute & School of Biological Sciences. 2. DATAHOLDER: Woodside and WAM.	1. CSIRO. DATAHOLDER: CSIRO [redacted]	1. Keesing 2019. 2. McLean et al. 2019.

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Chevron Australia (2011). Gorgon Gas Development and Jansz Feed Gas Pipeline: Dredging and spoil disposal Management and Monitoring Plan, Document number: G1-NT-PLNX0000373. Pp. 255. https://www.chevronaustralia.com/docs/default-source/default-documentlibrary/gorgon-emp-dredging-and-spoil-disposal-plan.pdf?sfvrsn=2

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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 and Glomar Shoals
Barrow and Lowendal Islands
Pilbara Islands - Southern Island Group
Montebello Is - Stephenson Channel Nth
Montebello Is Champagne Bay and Chippendale channel
Montebello Is - Claret Bay
Montebello Is - Hermite/Delta Is Channel
Montebello Is - Hock Bay
Montebello Is - North and Kelvin Channel
Montebello Is - Sherry Lagoon Entrance
Withnell Bay
Holden Bay
King Bay
No Name Bay / No Name Beach
Enderby Is -Dampier
Rosemary Island - Dampier
Legendre Is - Dampier
Karratha Gas Plant

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KGP to Whitnell Creek
KGP to Northern Shore
KGP Fire Pond and 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

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APPENDIX E NOPSEMA REPORTING FORMS

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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

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APPENDIX F STAKEHOLDER CONSULTATION

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Balnaves Plug and Abandonment Environment Plan

Date: July 2021

Revision: 0

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1. Consultation

1.1 Email sent to the following relevant stakeholders (8 March 2021)

- *Department of Transport (DoT)*
- *Department of Mines, Industry Regulation and Safety (DMIRS)*
- *Department of Industry, Science, Energy and Resources (DISER)*
- *Australian Petroleum Production and Exploration Association (APPEA)*
- *Australian Border Force (ABF)*

Dear stakeholder

Woodside is planning to submit an Environment Plan for the Plugging and Abandonment of 4 Balnaves wells around 169 km north west of Dampier, in permit area WA-49-L.

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:

Summary:	Plug and abandonment of 4 Balnaves wells; and removal of subsea infrastructure including Xmas trees and wellheads.
Location:	169 km north-west of Dampier
Approx. Water Depth (m):	~ 135 m
Schedule:	Commencement in 2022 and completion by end 2024
Duration:	~ 20 - 60 days per well to permanently plug the wells, ~ 7 days for Xmas tree cleaning, and ~ 2 – 5 days for infrastructure removal per Xmas tree and wellhead. Activities occur 24 hours per day, 365 days per year.
Exclusionary/Cautionary Zone:	A 4000 m radius Operational Area will apply around each well. This includes a temporary 500 m petroleum safety zone (exclusion zone).
Vessels:	Plugging and abandonment activities are planned to be undertaken from a moored MODU. An Inspection, Maintenance and Repair (IMR) or Anchor Handling Tug vessel will be mobilised prior to the MODU campaign to clean the Xmas trees and may be used to remove the infrastructure. Cutting and recovery of wellheads and Xmas trees will most likely be undertaken by an IMR vessel, but may be removed using the MODU and a support vessel. General support vessels for transporting equipment and materials to and from the Operational Area, and for general re-supply and support, may also be utilised.

Feedback:
If you have any issues or concerns with these activities, any other issues relevant to this location then please respond to Woodside at:

Feedback@woodside.com.au or [redacted]

Your feedback and our response will be included in our Environment Plans which will be submitted to 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).

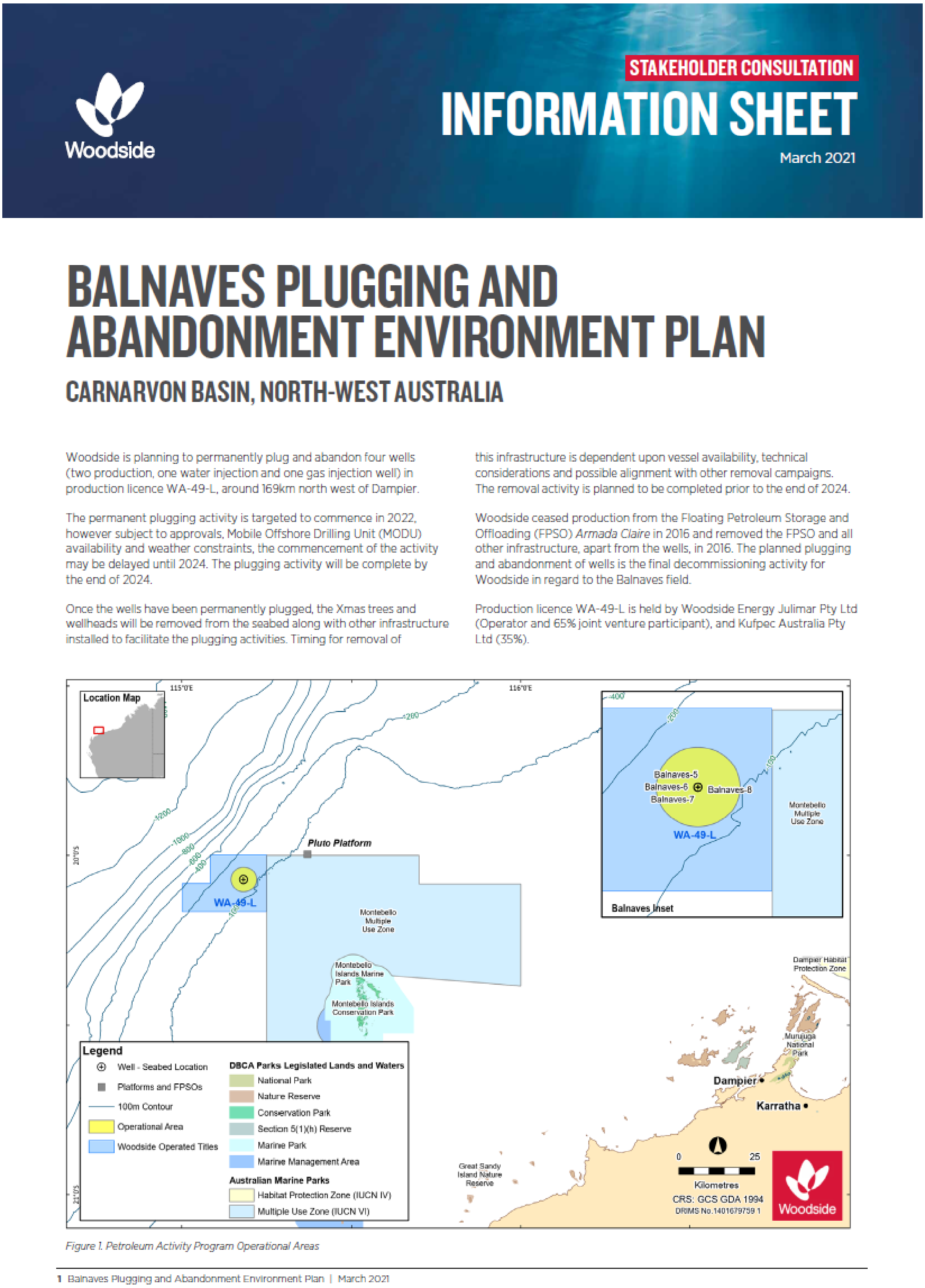
Please let us know if your feedback for this activity is sensitive and we will make this known to NOPSEMA upon submission of the Environment Plan in order for this information to remain confidential to NOPSEMA.

Please provide your views by 9 April 2021.

Regards

Graduate Corporate Affairs Advisor | Operations

1.2 Woodside Consultation Information Sheet (sent to all stakeholders)



Woodside

STAKEHOLDER CONSULTATION

INFORMATION SHEET

March 2021

BALNAVES PLUGGING AND ABANDONMENT ENVIRONMENT PLAN

CARNARVON BASIN, NORTH-WEST AUSTRALIA

Woodside is planning to permanently plug and abandon four wells (two production, one water injection and one gas injection well) in production licence WA-49-L, around 169km north west of Dampier.

The permanent plugging activity is targeted to commence in 2022, however subject to approvals, Mobile Offshore Drilling Unit (MODU) availability and weather constraints, the commencement of the activity may be delayed until 2024. The plugging activity will be complete by the end of 2024.

Once the wells have been permanently plugged, the Xmas trees and wellheads will be removed from the seabed along with other infrastructure installed to facilitate the plugging activities. Timing for removal of this infrastructure is dependent upon vessel availability, technical considerations and possible alignment with other removal campaigns. The removal activity is planned to be completed prior to the end of 2024.

Woodside ceased production from the Floating Petroleum Storage and Offloading (FPSO) *Armada Claire* in 2016 and removed the FPSO and all other infrastructure, apart from the wells, in 2016. The planned plugging and abandonment of wells is the final decommissioning activity for Woodside in regard to the Balnaves field.

Production licence WA-49-L is held by Woodside Energy Julimar Pty Ltd (Operator and 65% joint venture participant), and Kufpec Australia Pty Ltd (35%).

Figure 1. Petroleum Activity Program Operational Areas

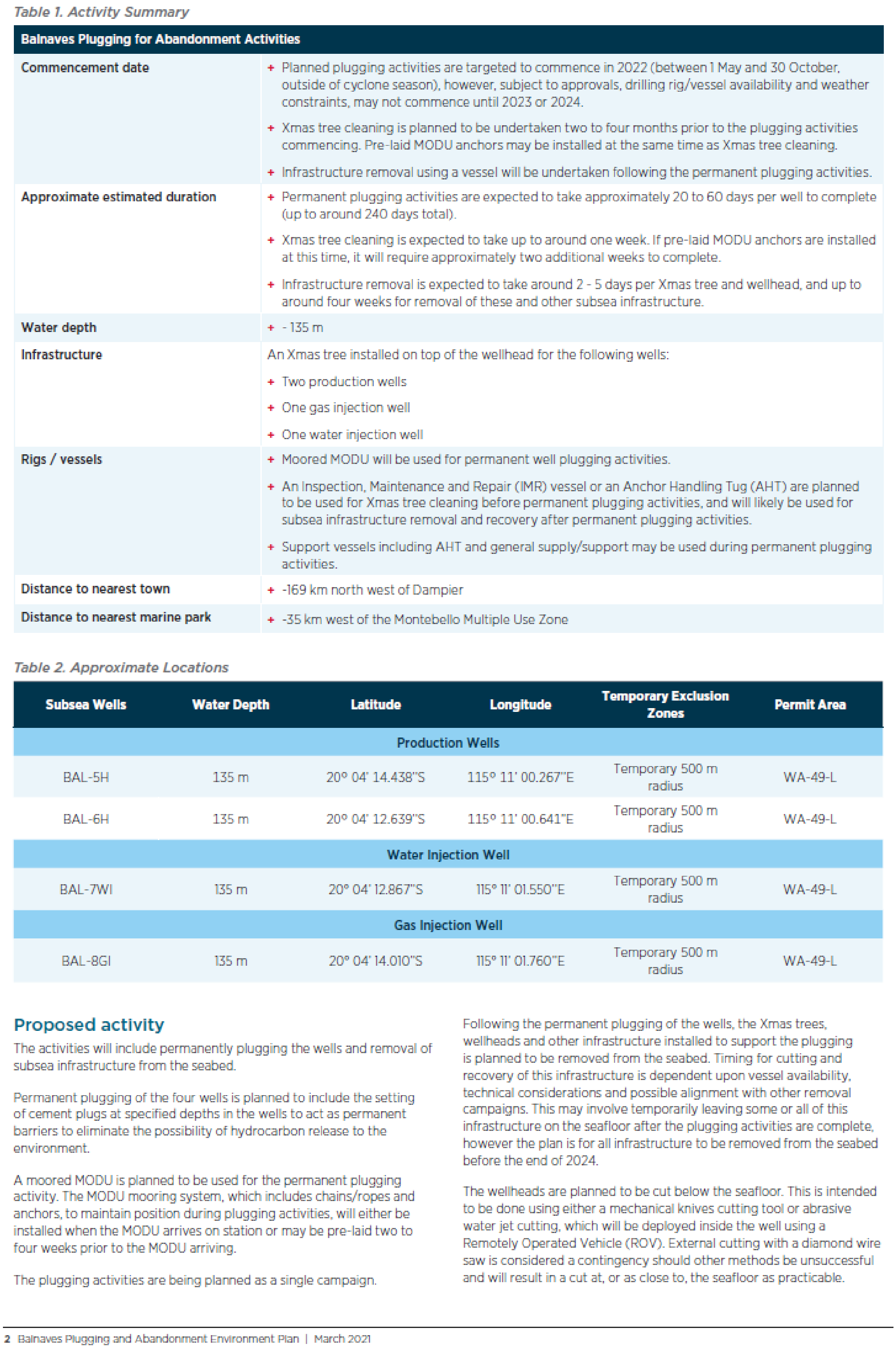


Table 1. Activity Summary

Balnaves Plugging for Abandonment Activities	
Commencement date	+ Planned plugging activities are targeted to commence in 2022 (between 1 May and 30 October, outside of cyclone season), however, subject to approvals, drilling rig/vessel availability and weather constraints, may not commence until 2023 or 2024. + Xmas tree cleaning is planned to be undertaken two to four months prior to the plugging activities commencing. Pre-laid MODU anchors may be installed at the same time as Xmas tree cleaning. + Infrastructure removal using a vessel will be undertaken following the permanent plugging activities.
Approximate estimated duration	+ Permanent plugging activities are expected to take approximately 20 to 60 days per well to complete (up to around 240 days total). + Xmas tree cleaning is expected to take up to around one week. If pre-laid MODU anchors are installed at this time, it will require approximately two additional weeks to complete. + Infrastructure removal is expected to take around 2 - 5 days per Xmas tree and wellhead, and up to around four weeks for removal of these and other subsea infrastructure.
Water depth	+ - 135 m
Infrastructure	An Xmas tree installed on top of the wellhead for the following wells: + Two production wells + One gas injection well + One water injection well
Rigs / vessels	+ Moored MODU will be used for permanent well plugging activities. + An Inspection, Maintenance and Repair (IMR) vessel or an Anchor Handling Tug (AHT) are planned to be used for Xmas tree cleaning before permanent plugging activities, and will likely be used for subsea infrastructure removal and recovery after permanent plugging activities. + Support vessels including AHT and general supply/support may be used during permanent plugging activities.
Distance to nearest town	+ -169 km north west of Dampier
Distance to nearest marine park	+ -35 km west of the Montebello Multiple Use Zone

Table 2. Approximate Locations

Subsea Wells	Water Depth	Latitude	Longitude	Temporary Exclusion Zones	Permit Area
Production Wells					
BAL-5H	135 m	20° 04' 14.438"S	115° 11' 00.267"E	Temporary 500 m radius	WA-49-L
BAL-6H	135 m	20° 04' 12.639"S	115° 11' 00.641"E	Temporary 500 m radius	WA-49-L
Water Injection Well					
BAL-7WI	135 m	20° 04' 12.867"S	115° 11' 01.550"E	Temporary 500 m radius	WA-49-L
Gas Injection Well					
BAL-8GI	135 m	20° 04' 14.010"S	115° 11' 01.760"E	Temporary 500 m radius	WA-49-L

Proposed activity

The activities will include permanently plugging the wells and removal of subsea infrastructure from the seabed.

Permanent plugging of the four wells is planned to include the setting of cement plugs at specified depths in the wells to act as permanent barriers to eliminate the possibility of hydrocarbon release to the environment.

A moored MODU is planned to be used for the permanent plugging activity. The MODU mooring system, which includes chains/ropes and anchors, to maintain position during plugging activities, will either be installed when the MODU arrives on station or may be pre-laid two to four weeks prior to the MODU arriving.

The plugging activities are being planned as a single campaign.

Following the permanent plugging of the wells, the Xmas trees, wellheads and other infrastructure installed to support the plugging is planned to be removed from the seabed. Timing for cutting and recovery of this infrastructure is dependent upon vessel availability, technical considerations and possible alignment with other removal campaigns. This may involve temporarily leaving some or all of this infrastructure on the seafloor after the plugging activities are complete, however the plan is for all infrastructure to be removed from the seabed before the end of 2024.

The wellheads are planned to be cut below the seafloor. This is intended to be done using either a mechanical knives cutting tool or abrasive water jet cutting, which will be deployed inside the well using a Remotely Operated Vehicle (ROV). External cutting with a diamond wire saw is considered a contingency should other methods be unsuccessful and will result in a cut at, or as close to, the seafloor as practicable.

The wellhead and Xmas tree removal might also be undertaken as multiple smaller campaigns on an opportunistic basis between other Woodside activities. Stakeholders will be advised should this occur.

Activities are expected to be undertaken 24 hours per day, seven days per week for the expected durations defined in Table 1 above.

Project vessels

Several vessel types may be required to complete the activities. Permanent plugging activities are planned to be undertaken from a moored MODU. An IMR or AHT vessel will be mobilised prior to the MODU campaign to clean the Xmas trees and may be used to remove the infrastructure. The activities may be supported by an AHT (to set anchors and support the MODU during plugging operations).

Cutting and recovery of wellheads and Xmas trees will most likely be undertaken with an IMR vessel, but may be removed using the MODU and a support vessel. General support vessels for transporting equipment and materials to and from the Operational Area, and for general re-supply and support, may also be utilised.

Communications with mariners

A 4000 m radius Operational Area will apply around each well to allow a moored MODU to undertake plugging and abandonment activities. This will include a temporary 500 m exclusion zone around the MODU during permanent plugging activities. A temporary 500 m exclusion zone will also be implemented around the vessel during infrastructure removal activities.

Marine notices will be issued prior to activity commencement to alert vessels which may be 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 Xmas tree cleaning, potential pre-laid MODU anchors installation, permanent plugging activities and infrastructure removal activities.

A number of mitigation and management measures during the permanent plugging activities are planned to be implemented and are summarised in Table 3. Further details will be provided in the Environment Plan.

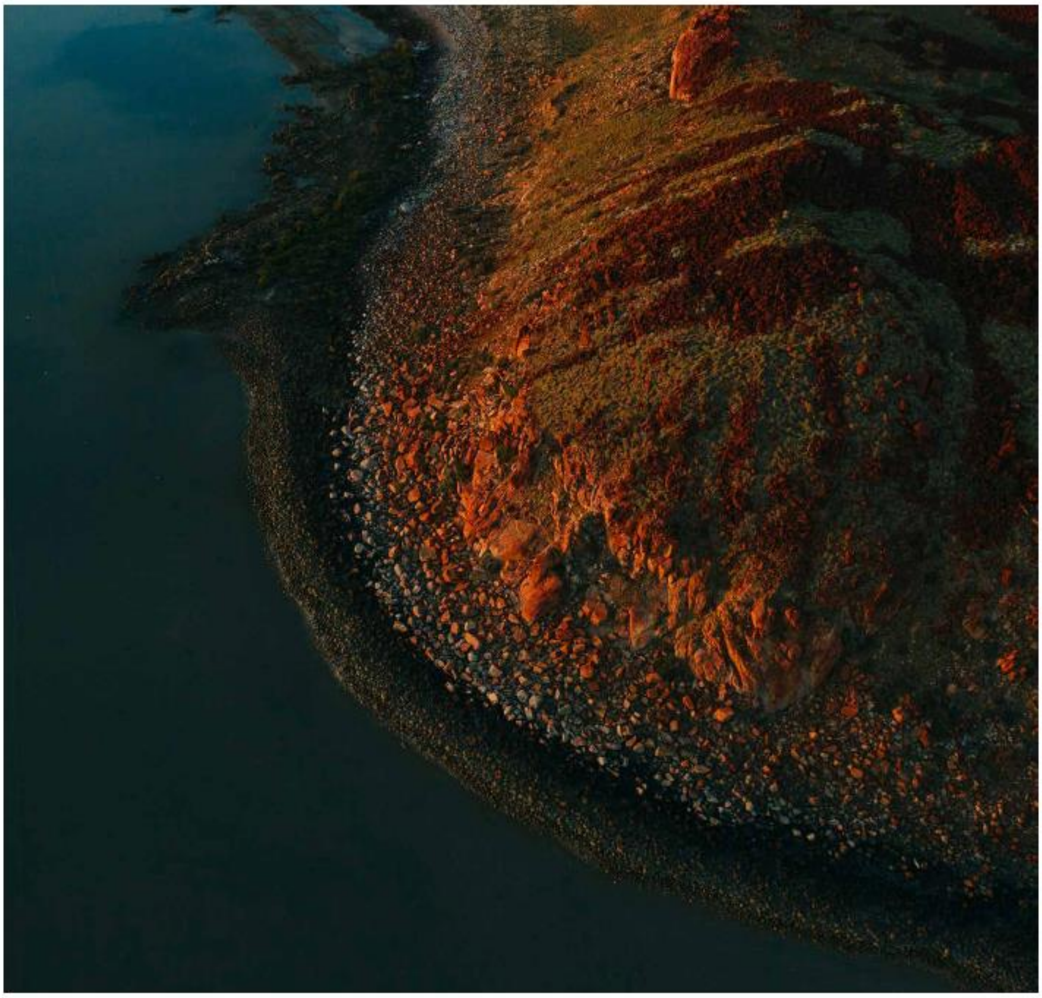


Table 3. Summary of key risks and/or impacts and management measures during permanent plugging and abandonment

Potential Risk and/or Impact	**Mitigation and/or Management Measure**
Planned	
Physical presence of infrastructure on seafloor causing interference or displacement	+ Wellhead/Xmas tree locations marked on marine charts until all infrastructure is removed. + All infrastructure planned to be removed by the end of 2024. + Navigation charts will be updated once all infrastructure removal activities are complete.
Chemical use	+ Chemical use will be managed in accordance with Woodside and contractor chemical selection and approval procedures.
Interests of relevant stakeholders including: + Defence activities + Petroleum activities + Commercial and recreational fishing 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.
Underwater noise	+ Due to the low acoustic source levels associated with vessel operations there is not likely to be any interaction or potential impact to fish hearing, feeding or spawning.
Light emissions	+ Implement relevant controls in the National Light Pollution Guidelines for Wildlife Including Marine Turtles, Seabirds and Migratory Shorebirds (2020).
Marine discharges	+ All routine marine discharges will be managed according to legislative and regulatory requirements and Woodside's Environmental Performance Standards where applicable.
Seabed disturbance	+ MODU mooring analysis, anchor deployment, if required, in accordance with Woodside standards. + Logging/retrieval of wet-stored items. + No anchoring of support vessels.
Vessel interaction	+ Navigation aids and practices will be used as required by Maritime Regulations to minimise potential impact on other marine users. + Notification to 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. + A temporary 500 m radius exclusion zone around the MODU (for plugging) and vessel (for removal) for the duration of activities. + A 4000 m radius Operational Area around each well. + 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. + Wastes will be managed and disposed of in a safe and environmentally responsible manner that prevents loss to the environment. + Wastes transported onshore will be sent to appropriate recycling or disposal facilities by a licensed waste contractor.
Emissions to atmosphere	+ Safely disposing of gas from the wellbore/production annulus by flaring or venting.
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.
Marine fauna interactions	+ Vessel masters will implement interaction management actions in accordance with the Environment Protection and Biodiversity Conservation Regulations 2000 (Cth).

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 **9 April 2021.**

Please note that, unless your feedback is notified as being sensitive (as below), your feedback and our response is required to 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).*

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.

Laura Fatovich, Corporate Affairs Woodside Energy Ltd
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.

www.woodside.com.au

Woodside

1.3 Email sent to Australian Maritime Safety Authority and Australian Hydrographic Office (8 March 2021)

Dear AMSA / AHO

Woodside is planning to submit an Environment Plan for the Plugging and Abandonment of 4 Balnaves wells around 169 km north west of Dampier, in permit area WA-49-L.

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 Shipping Lane map is also attached.

Activity:

Summary:	Plug and abandonment of 4 Balnaves wells; and removal of subsea infrastructure including Xmas trees and wellheads.
Location:	169 km north-west of Dampier
Approx. Water Depth (m):	~ 135 m
Schedule:	Commencement in 2022 and completion by end 2024
Duration:	~ 20 - 60 days per well to permanently plug the wells, ~ 7 days for Xmas tree cleaning, and ~ 2 – 5 days for infrastructure removal per Xmas tree and wellhead. Activities occur 24 hours per day, 365 days per year.
Exclusionary/Cautionary Zone:	A 4000 m radius Operational Area will apply around each well. This includes a temporary 500 m petroleum safety zone (exclusion zone).
Vessels:	Plugging and abandonment activities are planned to be undertaken from a moored MODU. An Inspection, Maintenance and Repair (IMR) or Anchor Handling Tug vessel will be mobilised prior to the MODU campaign to clean the Xmas trees and may be used to remove the infrastructure. Cutting and recovery of wellheads and Xmas trees will most likely be undertaken by an IMR vessel, but may be removed using the MODU and a support vessel. General support vessels for transporting equipment and materials to and from the Operational Area, and for general re-supply and support, may also be utilised.

Balnaves Well Locations:

Subsea Wells	Water Depth (m)	Latitude	Longitude	Exclusion Zones	Permit Area
			Production Wells		
BAL-5H	135 m	20° 04’ 14.438’’S	115° 11’ 00.267’’E	Temporary 500 m radius	WA-49-L
BAL-6H	135 m	20° 04’ 12.639’’S	115° 11’ 00.641”E	Temporary 500 m radius	WA-49-L

Subsea Wells	Water Depth (m)	Latitude	Longitude	Exclusion Zones	Permit Area
			Water Injection Wells		
BAL-7WI	135 m	20° 04’ 12.867’’S	115° 11’ 01.550’’E	Temporary 500 m radius	WA-49-L
			Gas Injection Wells		
BAL-8GI	135 m	20° 04’ 14.010’’S	115° 11’ 01.760’’E	Temporary 500 m radius	WA-49-L

Feedback:

If you have any issues or concerns with these activities, any other issues relevant to this location then please respond to Woodside at:

Feedback@woodside.com.au or [redacted]

Your feedback and our response will be included in our Environment Plans which will be submitted to 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).

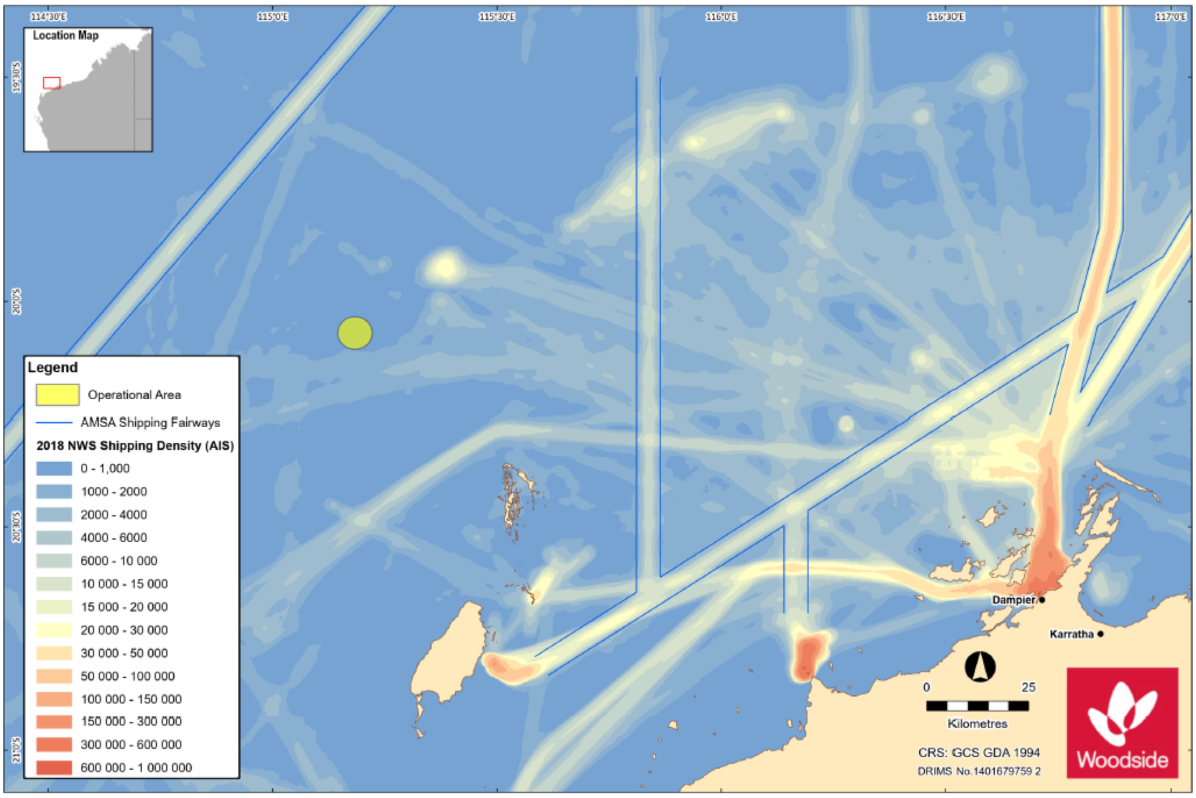
Please let us know if your feedback for this activity is sensitive and we will make this known to NOPSEMA upon submission of the Environment Plan in order for this information to remain confidential to NOPSEMA.

Please provide your views by 9 April 2021.

Regards

Graduate Corporate Affairs Advisor | Operations

1.4 Shipping lane map sent to AMSA and AHO (8 March 2021)



1.5 Email sent to Department of Agriculture, Water and the Environment (8 March 2021)

Dear DAWE

Woodside is planning to submit an Environment Plan for the Plugging and Abandonment of 4 Balnaves wells around 169 km north west of Dampier, in permit area WA-49-L.

We have assessed Commonwealth fisheries based on fishing licence overlap with the activity area, assessment of government fishing effort data (AFMA) from recent years, fishing methods and water depth; and consider no Commonwealth fisheries are of relevance to this proposed activity.

We have also assessed biosecurity matters which are considered below.

An information sheet (also on our website), and a map of relevant fisheries is attached.

Activity:

Summary:	Plug and abandonment of 4 Balnaves wells; and removal of subsea infrastructure including Xmas trees and wellheads.
Location:	169 km north-west of Dampier
Approx. Water Depth (m):	~ 135 m
Schedule:	Commencement in 2022 and completion by end 2024

Duration:	~ 20 - 60 days per well to permanently plug the wells, ~ 7 days for Xmas tree cleaning, and ~ 2 – 5 days for infrastructure removal per Xmas tree and wellhead. Activities occur 24 hours per day, 365 days per year.
Exclusionary/Cautionary Zone:	A 4000 m radius Operational Area will apply around each well. This includes a temporary 500 m petroleum safety zone (exclusion zone).
Vessels:	Plugging and abandonment activities are planned to be undertaken from a moored MODU. An Inspection, Maintenance and Repair (IMR) or Anchor Handling Tug vessel will be mobilised prior to the MODU campaign to clean the Xmas trees and may be used to remove the infrastructure. Cutting and recovery of wellheads and Xmas trees will most likely be undertaken by an IMR vessel, but may be removed using the MODU and a support vessel. General support vessels for transporting equipment and materials to and from the Operational Area, and for general re-supply and support, may also be utilised.

Balnaves Well Locations:

Subsea Wells	Water Depth (m)	Latitude	Longitude	Exclusion Zones	Permit Area
			Production Wells		
BAL-5H	135 m	20° 04' 14.438''S	115° 11' 00.267''E	Temporary 500 m radius	WA-49-L
BAL-6H	135 m	20° 04' 12.639''S	115° 11' 00.641''E	Temporary 500 m radius	WA-49-L
			Water Injection Wells		
BAL-7WI	135 m	20° 04' 12.867''S	115° 11' 01.550''E	Temporary 500 m radius	WA-49-L
			Gas Injection Wells		
BAL-8GI	135 m	20° 04' 14.010''S	115° 11' 01.760''E	Temporary 500 m radius	WA-49-L

Biosecurity:

With respect to the biosecurity matters, please note the following information below:

Environment description:

The Operational Area is located in water depths of 110-160 m on the middle continental shelf and the seabed is relatively flat and featureless, comprised of soft sediments. However there is the ancient coastline at the 125 m depth contour, which is designated as a KEF overlapping spatially with the Operational Area. No significant escarpments, emergent features or areas of high biological productivity characteristically associated with the ancient coastline were recorded during all seabed surveys of the Operational Area.

Potential IMS risk	***IMS mitigation management***
Introduction or translocation and establishment of invasive marine species to the area via biofouling on vessels or within vessels ballast water systems.	Vessels are required to comply with the Australian Biosecurity Act 2015, specifically the Australian Ballast Water Management Requirements (as defined under the Biosecurity Act 2015) (aligned with the International Convention for the Control and Management of Ships' Ballast Water and Sediments) to prevent introducing IMS. 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.

Feedback:

If you have any issues or concerns with these activities, any other issues relevant to this location then please respond to Woodside at:

Feedback@woodside.com.au or [redacted]

Your feedback and our response will be included in our Environment Plans which will be submitted to 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).

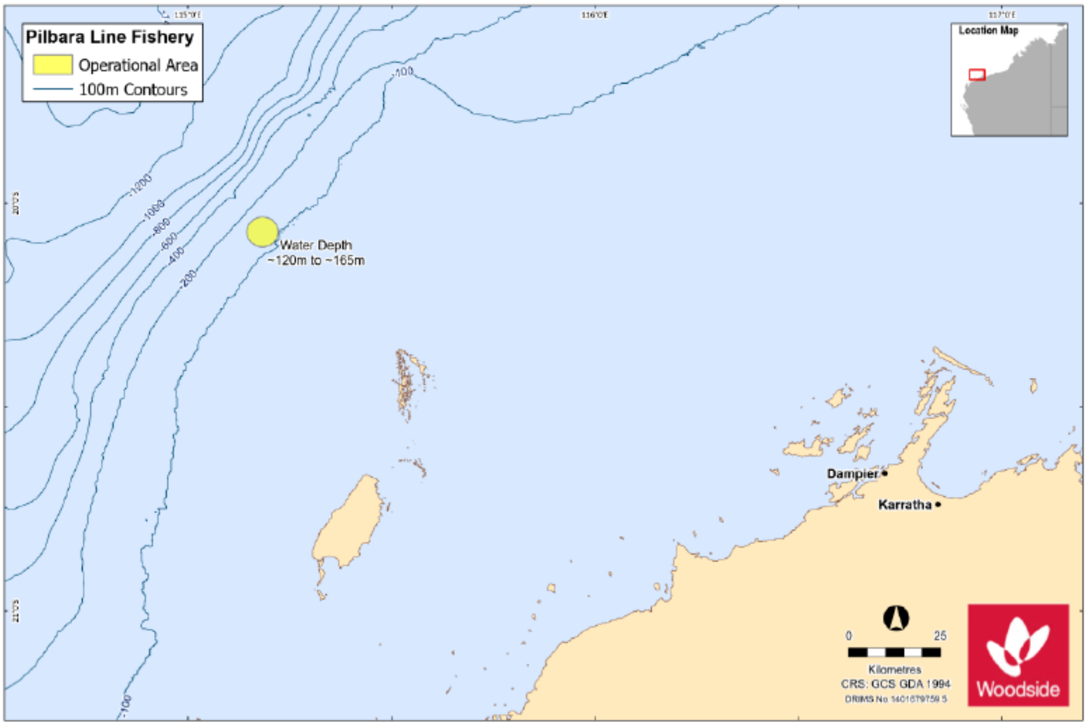
Please let us know if your feedback for this activity is sensitive and we will make this known to NOPSEMA upon submission of the Environment Plan in order for this information to remain confidential to NOPSEMA.

Please provide your views by 9 April 2021.

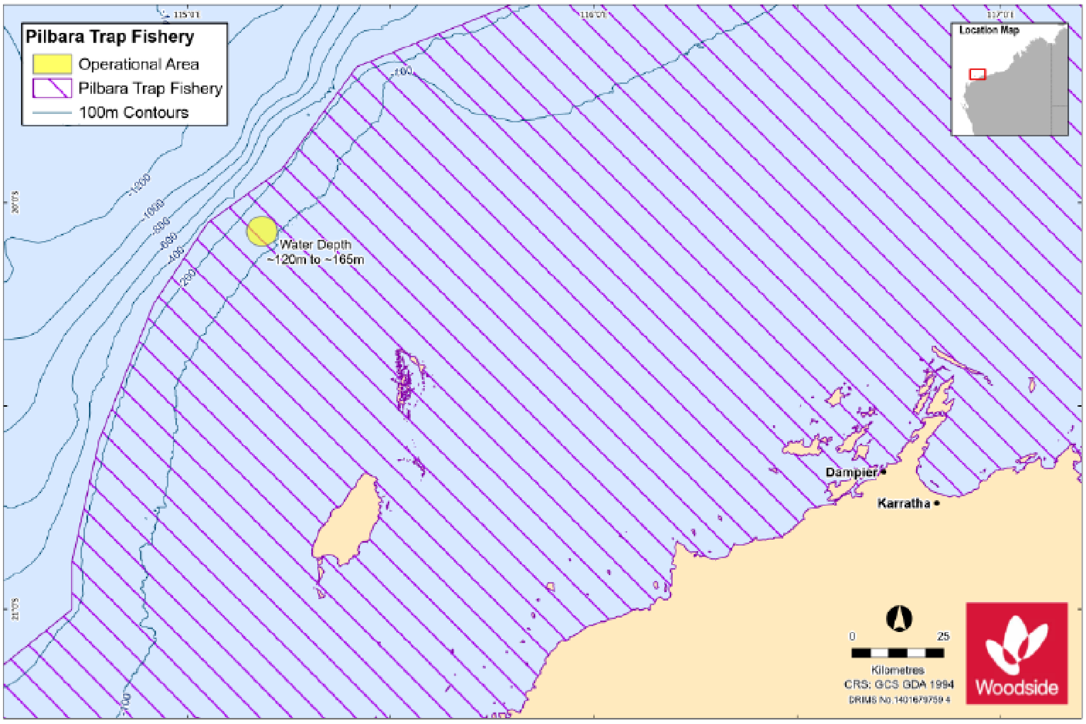
Regards
Graduate Corporate Affairs Adviser | Operations

1.6 Map of Relevant Fisheries, sent to Department of Agriculture, Water and the Environment, WAFIC, Pearl Producers Association, Department of Primary Industries and Regional Development (8 March 2021)

Pilbara Line Fishery



Pilbara Trap Fishery



1.7 Email sent to Department of Defence (8 March 2021)

Dear Department of Defence

Woodside is planning to submit an Environment Plan for the Plugging and Abandonment of 4 Balnaves wells around 169 km north west of Dampier, in permit area WA-49-L.

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 defence areas map is also attached.

Activity:

Summary:	Plug and abandonment of 4 Balnaves wells; and removal of subsea infrastructure including Xmas trees and wellheads.
Location:	169 km north-west of Dampier
Approx. Water Depth (m):	~ 135 m
Schedule:	Commencement in 2022 and completion by end 2024
Duration:	~ 20 - 60 days per well to permanently plug the wells, ~ 7 days for Xmas tree cleaning, and ~ 2 – 5 days for infrastructure removal per Xmas tree and wellhead. Activities occur 24 hours per day, 365 days per year.
Exclusionary/Cautionary Zone:	A 4000 m radius Operational Area will apply around each well. This includes a temporary 500 m petroleum safety zone (exclusion zone).
Vessels:	Plugging and abandonment activities are planned to be undertaken from a moored MODU. An Inspection, Maintenance and Repair (IMR) or Anchor Handling Tug vessel will be mobilised prior to the MODU campaign to clean the Xmas trees and may be used to remove the infrastructure. Cutting and recovery of wellheads and Xmas trees will most likely be undertaken by an IMR vessel, but may be removed using the MODU and a support vessel. General support vessels for transporting equipment and materials to and from the Operational Area, and for general re-supply and support, may also be utilised.

Feedback:

If you have any issues or concerns with these activities, any other issues relevant to this location then please respond to Woodside at:

Feedback@woodside.com.au or [redacted]

Your feedback and our response will be included in our Environment Plans which will be submitted to 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).

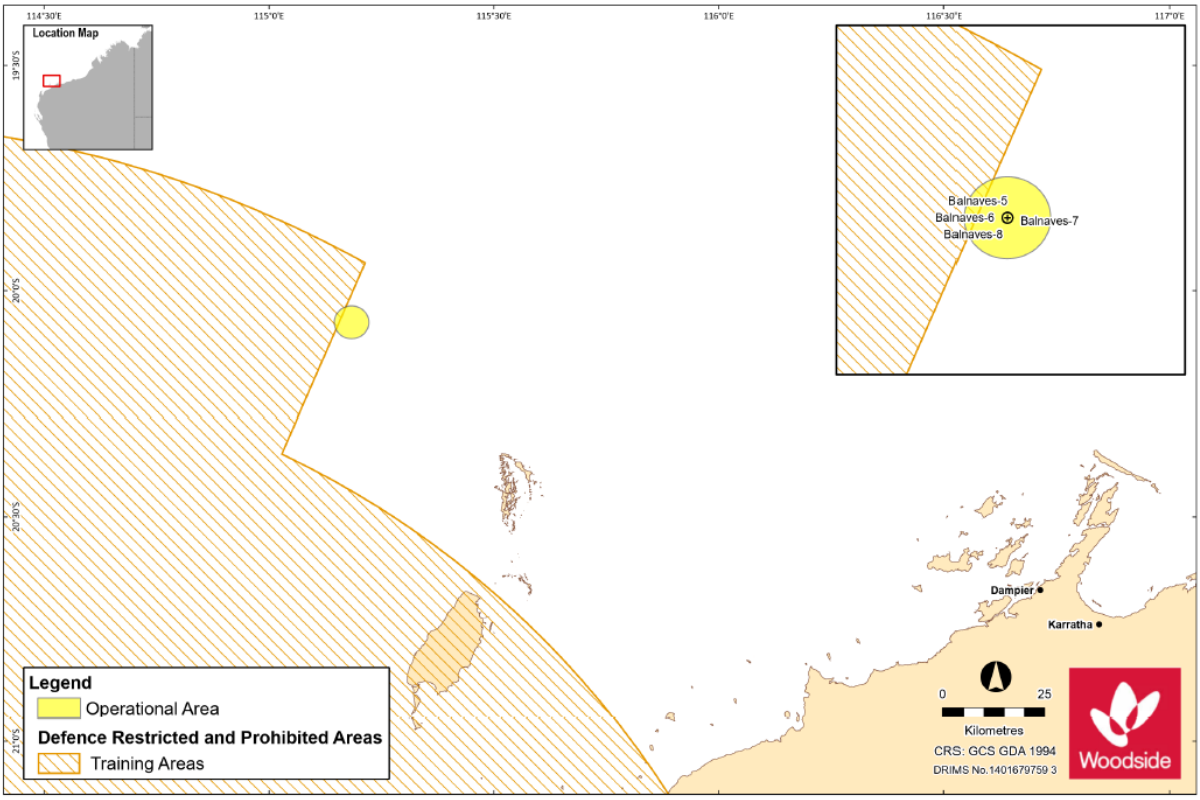
Please let us know if your feedback for this activity is sensitive and we will make this known to NOPSEMA upon submission of the Environment Plan in order for this information to remain confidential to NOPSEMA.

Please provide your views by 9 April 2021.

Regards

Graduate Corporate Affairs Adviser | Operations

1.8 Defence area map sent to Department of Defence (8 March 2021)



1.9 Email sent to Director of National Parks (8 March 2021)

Dear Director of National Parks

Woodside is consulting stakeholders on the Environment Plan (EP) for the Plugging and Abandonment of 4 Balnaves wells around 169 km north west of Dampier, in permit area WA-49-L.

A Consultation Information Sheet about the planned activity is attached, which provides background on the activity, including a summary of potential key risks and associated management measures. The Information Sheet is also available on our website.

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 a proclaimed Australian Marine Parks, with activities taking place approximately 35 km north west of Montebello Multiple Use Zone
- We have assessed potential risks to Australian Marine Parks (AMPs) 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 this EP is the remote likelihood event of a subsea well blow-out. For this to occur, the Xmas tree on top of the well must be completely removed along with the failure of multiple barriers within the well. Given the controls in place to prevent and control loss of containment events, it is considered that the risk associated with a subsea well blow-out is managed to as low as reasonably practicable.
- Through review of hydrocarbon spill modelling, and with consideration of a 10 ppb dissolved and entrained hydrocarbon threshold, the following AMPs may be contacted in the event of a spill:

    - Montebello
    - Gascoyne
    - Ningaloo
    - Carnarvon Canyon
    - Shark Bay
    - Abrolhos
    - Jurien Bay
    - Perth Canyon
    - South-west Corner

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 the Marine Park.

Activity:

Summary:	Plug and abandonment of 4 Balnaves wells; and removal of subsea infrastructure including Xmas trees and wellheads.
Location:	169 km north-west of Dampier
Approx. Water Depth (m):	~ 135 m
Schedule:	Commencement in 2022 and completion by end 2024
Duration:	~ 20 - 60 days per well to permanently plug the wells, ~ 7 days for Xmas tree cleaning, and ~ 2 – 5 days for infrastructure removal per Xmas tree and wellhead. Activities occur 24 hours per day, 365 days per year.
Exclusionary/Cautionary Zone:	A 4000 m radius Operational Area will apply around each well. This includes a temporary 500 m petroleum safety zone (exclusion zone).
Vessels:	Plugging and abandonment activities are planned to be undertaken from a moored MODU. An Inspection, Maintenance and Repair (IMR) or Anchor Handling Tug vessel will be mobilised prior to the MODU campaign to clean the Xmas trees and may be used to remove the infrastructure. Cutting and recovery of wellheads and Xmas trees will most likely be undertaken by an IMR vessel, but may be removed using the MODU and a support vessel. General support vessels for transporting equipment and materials to and from the Operational Area, and for general re-supply and support, may also be utilised.

Feedback:

If you have any issues or concerns with these activities, any other issues relevant to this location then please respond to Woodside at:

Feedback@woodside.com.au or [redacted]

Your feedback and our response will be included in our Environment Plans which will be submitted to 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).

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 9 April 2021.

Regards

Graduate Corporate Affairs Adviser | Operations

1.10 Email sent to Director of National Parks (17 March 2021)

Dear Director of National Parks

Further to my email below, please see an update on the following AMPs who may be contacted in the event of a spill:

- Abrolhos
- Argo-Rowley Terrace
- Carnarvon
- Gascoyne
- Montebello
- Ningaloo
- Shark Bay

Regards

Graduate Corporate Affairs Adviser | Operations

1.11 Email sent to adjacent titleholder (operator) – Chevron (8 March 2021)

Dear Titleholder

As operator of adjacent titles, we are sending this information to you.

Woodside is planning to submit an Environment Plan for the Plugging and Abandonment of 4 Balnaves wells around 169 km north west of Dampier, in permit area WA-49-L.

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 Titleholders map is also attached.

Activity:

Balnaves Plug and Abandonment Environment Plan

Summary:	Plug and abandonment of 4 Balnaves wells; and removal of subsea infrastructure including Xmas trees and wellheads.
Location:	169 km north-west of Dampier
Approx. Water Depth (m):	~ 135 m
Schedule:	Commencement in 2022 and completion by end 2024
Duration:	~ 20 - 60 days per well to permanently plug the wells, ~ 7 days for Xmas tree cleaning, and ~ 2 – 5 days for infrastructure removal per Xmas tree and wellhead. Activities occur 24 hours per day, 365 days per year.
Exclusionary/Cautionary Zone:	A 4000 m radius Operational Area will apply around each well. This includes a temporary 500 m petroleum safety zone (exclusion zone).
Vessels:	Plugging and abandonment activities are planned to be undertaken from a moored MODU. An Inspection, Maintenance and Repair (IMR) or Anchor Handling Tug vessel will be mobilised prior to the MODU campaign to clean the Xmas trees and may be used to remove the infrastructure. Cutting and recovery of wellheads and Xmas trees will most likely be undertaken by an IMR vessel, but may be removed using the MODU and a support vessel. General support vessels for transporting equipment and materials to and from the Operational Area, and for general re-supply and support, may also be utilised.

Feedback:

If you have any issues or concerns with these activities, any other issues relevant to this location then please respond to Woodside at:

Feedback@woodside.com.au or [redacted]

Your feedback and our response will be included in our Environment Plans which will be submitted to 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).

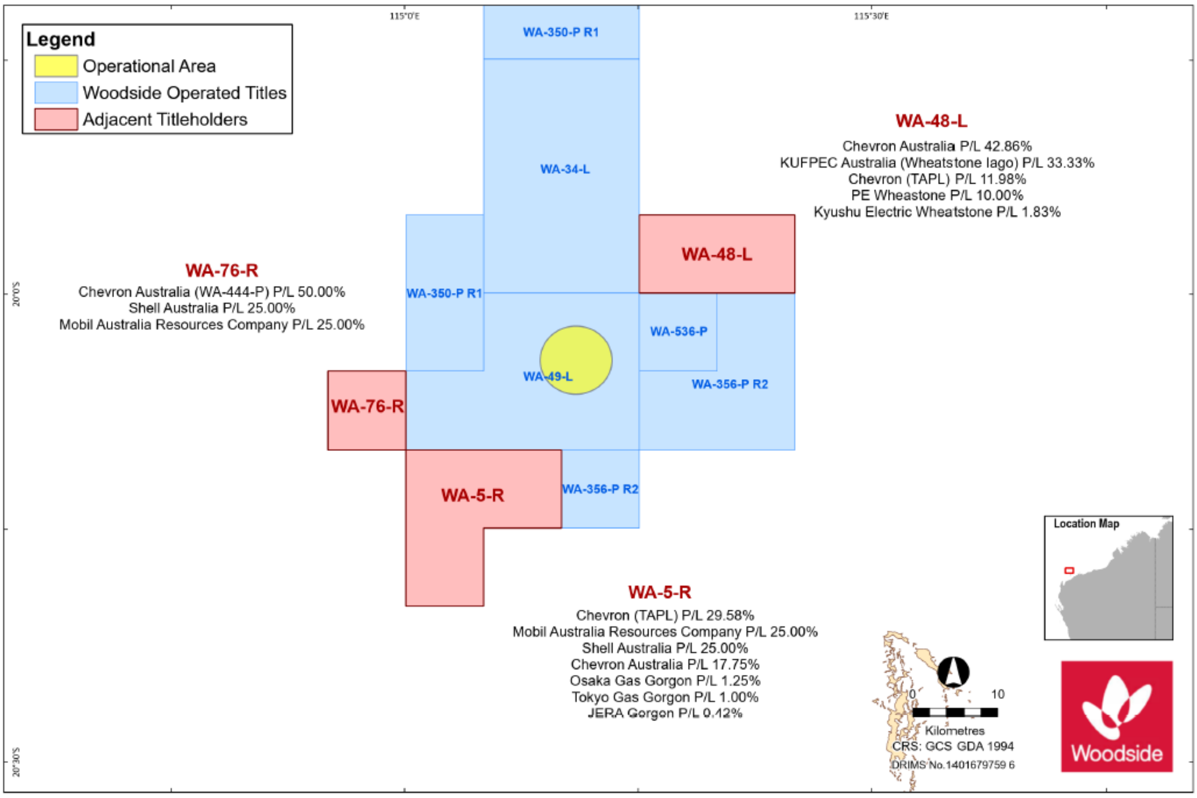
Please let us know if your feedback for this activity is sensitive and we will make this known to NOPSEMA upon submission of the Environment Plan in order for this information to remain confidential to NOPSEMA.

Please provide your views by 9 April 2021.

Regards

Graduate Corporate Affairs Advisor | Operations

1.12 Titles map sent to adjacent titleholder (operator) – Chevron (8 March 2021)



1.13 Email sent to adjacent titleholder (operator) – Chevron (9 June 2021)

Dear Chevron,

I am following up on the below email regarding our proposed Balnaves P&A activities to understand whether Chevron may have any feedback.

The Balnaves wells are located approximately 1.8 km from the Wheatstone trunkline. The P&A activity is to use a moored MODU, and is planned to be undertaken outside of cyclone season to minimise the risk of anchor drag. Non-cyclone moorings are to be designed and installed to ensure the risk to the Wheatstone trunkline from a 'drift-off' condition is ALARP. This includes designing to the industry standard of 100 m separation of moorings to infrastructure requirement as defined in API-RP-2SK.

The dates for the P&A activities are yet to be determined however, Woodside can notify Chevron of the activities if requested.

Should you have any feedback or would like to discuss further please let me know by 16 June.

Regards,

Graduate Corporate Affairs Advisor | Operations

1.14 Email sent to Department of Primary Industries and Regional Development (11 February 2021)

Dear [redacted]

Balnaves Plug and Abandonment Environment Plan

Woodside is planning to submit an Environment Plan for the Plugging and Abandonment of 4 Balnaves wells around 169 km north west of Dampier, in permit area WA-49-L.
The activity is planned to commence during 2022 and completed by the end of 2024 in water depths around 135 m.

A temporary 500 m exclusion zone will apply around the Mobile Offshore Drilling Unit (MODU) and vessels undertaking the removal activities.

We have identified potential impacts to active commercial fishers and the environment, which are summarised below. We have endeavoured to reduce these risks to an as low as reasonably practicable level.

An information sheet (also on our website), and a map of relevant fisheries is attached.

Fisheries have been identified as being relevant based on fishing licence overlap with the activity area, assessment of government fishing effort data (including Fishcube and AFMA) from recent years, fishing methods and water depth.

Activity:

Summary:	Plug and abandonment of 4 Balnaves wells; and removal of subsea infrastructure including Xmas trees and wellheads.
Location:	169 km north-west of Dampier
Approx. Water Depth (m):	~ 135 m
Schedule:	Commencement in 2022 and completion by end 2024
Duration:	~ 20 - 60 days per well to permanently plug the wells, ~ 7 days for Xmas tree cleaning, and ~ 2 – 5 days for infrastructure removal per Xmas tree and wellhead. Activities occur 24 hours per day, 365 days per year.
Relevant State Fisheries	State: Pilbara Demersal Scalefish Fisheries – Pilbara Line and Pilbara Trap Commonwealth: no relevant fisheries.
Exclusionary/Cautionary Zone:	A 4000 m radius Operational Area will apply around each well. This includes a temporary 500 m petroleum safety zone (exclusion zone).
Vessels:	Plugging and abandonment activities are planned to be undertaken from a moored MODU. An Inspection, Maintenance and Repair (IMR) or Anchor Handling Tug vessel will be mobilised prior to the MODU campaign to clean the Xmas trees and may be used to remove the infrastructure. Cutting and recovery of wellheads and Xmas trees will most likely be undertaken by an IMR vessel, but may be removed using the MODU and a support vessel. General support vessels for transporting equipment and materials to and from the Operational Area, and for general re-supply and support, may also be utilised.

Balnaves Well Locations:

Subsea Wells	Water Depth (m)	Latitude	Longitude	Exclusion Zones	Permit Area
Production Wells					
BAL-5H	135 m	20° 04’ 14.438’’S	115° 11’ 00.267’’E	Temporary 500 m radius	WA-49-L
BAL-6H	135 m	20° 04’ 12.639’’S	115° 11’ 00.641’’E	Temporary 500 m radius	WA-49-L
Water Injection Wells					
BAL-7WI	135 m	20° 04’ 12.867’’S	115° 11’ 01.550’’E	Temporary 500 m radius	WA-49-L
Gas Injection Wells					
BAL-8GI	135 m	20° 04’ 14.010’’S	115° 11’ 01.760’’E	Temporary 500 m radius	WA-49-L

Potential risks to commercial fishing and proposed mitigation measures:

Potential Risk	Risk Description	Mitigation And / Or Management Measures
Planned		
Physical presence of infrastructure on seafloor causing interference or displacement	Physical presence of infrastructure on the seafloor causing temporary interference / displacement	Wellhead location marked on marine charts Wellheads planned to be removed as part of plugging and abandonment
Underwater noise	Noise will be generated by project vessels	Due to the low acoustic source levels associated with vessel operations there is not likely to be any interaction or potential impact to fish hearing, feeding or spawning
Marine discharges	Discharges from the operation of project vessels may include sewage, grey water, drain and bilge 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	All routine marine discharges will be managed according to legislative and regulatory requirements and Woodside’s Environmental Performance Standards where applicable
Seabed disturbance	Disturbance to the seabed from plugging and abandonment, and removal activities	MODU mooring analysis, anchor deployment, if required, in accordance with Woodside standards. Logging/retrieval of wet-stored items. No anchoring of support vessels.
Vessel interaction	The presence of vessels may preclude other marine users from access to the area	Navigation aids and practices will be used as required by Maritime Regulations to minimise potential impact on other marine users. Notification to 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 A 500 m radius petroleum safety zone (temporary exclusion zone) around the MODU (for plugging) and vessel (for removal) for the duration of activities A 4000 m radius Operational Area around each well Commercial fishers and other marine users are permitted to use but should take care when entering the Operational Area
Unplanned Risks		
Hydrocarbon release	Loss of hydrocarbons to the marine environment from a well or vessel collision resulting in a tank rupture.	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
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

Feedback:

If you have any issues or concerns with these activities, any other issues relevant to this location then please respond to Woodside at:

Feedback@woodside.com.au or [redacted]

Your feedback and our response will be included in our Environment Plans which will be submitted to 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).

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 9 April 2021.

Regards

Graduate Corporate Affairs Advisor | Operations

1.15 Email sent to WAFIC (8 March 2021)

Dear [redacted]

I have spoken with [redacted] and provide the following consultation information below (and attached) relating to Woodside's proposed Environment Plan for the Plugging and Abandonment of 4 Balnaves wells around 169 km north west of Dampier, in permit area WA-49-L.

The activity is planned to commence during 2022 and completed by the end of 2024 in water depths around 135 m. A temporary 500 m exclusion zone will apply around the Mobile Offshore Drilling Unit (MODU) and vessels undertaking the activity.

We have identified potential impacts to active commercial fishers and the environment, which are summarised below. We have endeavoured to reduce these risks to an as low as reasonably practicable level.

An information sheet (also on our website), and a map of relevant fisheries is attached.

Fisheries have been identified as being relevant based on fishing licence overlap with the activity area, assessment of government fishing effort data (including Fishcube and AFMA) from recent years, fishing methods and water depth.

We welcome WAFIC's feedback on the activity and information provided by 15 March 2021, and subject to this feedback, we will consult individual relevant Licence Holders.

Activity:

Summary	Plug and abandonment of 4 Balnaves wells; and removal of subsea infrastructure including Xmas trees and wellheads
Location:	169 km north-west of Dampier
Approx. Water Depth (m):	~ 135 m
Schedule:	Commencement in 2022 and completion by end 2024
Duration:	~ 20 - 60 days per well to permanently plug the wells, ~ 7 days for Xmas tree cleaning, and ~ 2 – 5 days for infrastructure removal per Xmas tree and wellhead. Activities occur 24 hours per day, 365 days per year.
Relevant State Fisheries	State: Pilbara Demersal Scalefish Fisheries – Pilbara Line and Pilbara Trap. Based on your recent feedback for the Enfield Plugging and Abandonment Environment Plan (email attached), we propose to notify these Licence Holders prior to, and on completion of, the activity
Exclusionary/Cautionary Zone:	A 4000 m radius Operational Area will apply around each well (Woodside staff, contractors, and sub-contractors will be fully briefed on the status of the Operational cautionary zone, including that commercial fishers are able to enter the area when safe to do so). This includes a temporary 500 m exclusion zone (which will be removed as soon as possible following the activity).
Vessels:	Plugging and abandonment activities are planned to be undertaken from a moored MODU. An Inspection, Maintenance and Repair (IMR) or Anchor Handling Tug vessel will be mobilised prior to the MODU campaign to clean the Xmas trees and may be used to remove the infrastructure. Cutting and recovery of wellheads and Xmas trees will most likely be undertaken by an IMR vessel, but may be removed using the MODU and a support vessel. General support vessels for transporting equipment and materials to and from the Operational Area, and for general re-supply and support, may also be utilised.

Balnaves Well Locations:

Subsea Wells	Water Depth (m)	Latitude	Longitude	Exclusion Zones	Permit Area
			Production Wells		
BAL-5H	135 m	20° 04' 14.438''S	115° 11' 00.267''E	Temporary 500 m radius	WA-49-L
BAL-6H	135 m	20° 04' 12.639''S	115° 11' 00.641"E	Temporary 500 m radius	WA-49-L
			Water Injection Wells		
BAL-7WI	135 m	20° 04' 12.867''S	115° 11' 01.550''E	Temporary 500 m radius	WA-49-L
			Gas Injection Wells		
BAL-8GI	135 m	20° 04' 14.010''S	115° 11' 01.760''E	Temporary 500 m radius	WA-49-L

Potential risks to commercial fishing and proposed mitigation measures:

Potential Risk	Risk Description	Mitigation And / Or Management Measures
Planned		
Physical presence of infrastructure on seafloor causing interference or displacement	Physical presence of infrastructure on the seafloor causing temporary interference / displacement	Wellhead location marked on marine charts Wellheads planned to be removed as part of plugging and abandonment
Underwater noise	Noise will be generated by project vessels	Due to the low acoustic source levels associated with vessel operations there is not likely to be any interaction or potential impact to fish hearing, feeding or spawning
Marine discharges	Discharges from the operation of project vessels may include sewage, grey water, drain and bilge 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	All routine marine discharges will be managed according to legislative and regulatory requirements and Woodside's Environmental Performance Standards where applicable
Seabed disturbance	Disturbance to the seabed from plugging and abandonment, and removal activities	MODU mooring analysis, anchor deployment, if required, in accordance with Woodside standards. Logging/retrieval of wet-stored items. No anchoring of support vessels.
Vessel interaction	The presence of vessels may preclude other marine users from access to the area	Navigation aids and practices will be used as required by Maritime Regulations to minimise potential impact on other marine users.

		Notification to 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 A 500 m radius temporary exclusion zone around the MODU and vessel undertaking the activity for the duration of activities A 4000 m radius Operational Area around each well Commercial fishers and other marine users are permitted to use but should take care when entering the Operational Area
Unplanned Risks		
Hydrocarbon release	Loss of hydrocarbons to the marine environment from a well or vessel collision resulting in a tank rupture.	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
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

Feedback:

We would appreciate any feedback by **15 March 2021** and subject to any comments, we would then consult individual Licence Holders.

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).

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.

Regards

Graduate Corporate Affairs Advisor | Operations

1.16 Email sent to Pearl Producers Association (8 March 2021)

Dear [redacted]

Woodside is planning to submit an Environment Plan for the Plugging and Abandonment of 4 Balnaves wells around 169 km north west of Dampier, in permit area WA-49-L.

The activity is planned to commence during 2022 and completed by the end of 2024 in water depths around 135 m.

A temporary 500 m exclusion zone will apply around the Mobile Offshore Drilling Unit (MODU) and vessel undertaking the activity.

We have identified potential impacts to active commercial fishers and the environment, which are summarised below. We have endeavoured to reduce these risks to an as low as reasonably practicable level.

An information sheet (also on our website), and a map of relevant fisheries is attached.

Fisheries have been identified as being relevant based on fishing licence overlap with the activity area, assessment of government fishing effort data (including Fishcube and AFMA) from recent years, fishing methods and water depth.

Activity:

Summary:	Plug and abandonment of 4 Balnaves wells; and removal of subsea infrastructure including Xmas trees and wellheads.
Location:	169 km north-west of Dampier
Approx. Water Depth (m):	~ 135 m
Schedule:	Commencement in 2022 and completion by end 2024
Duration:	~ 20 - 60 days per well to permanently plug the wells, ~ 7 days for Xmas tree cleaning, and ~ 2 – 5 days for infrastructure removal per Xmas tree and wellhead. Activities occur 24 hours per day, 365 days per year.
Relevant State Fisheries	State: Pilbara Demersal Scalefish Fisheries – Pilbara Line and Pilbara Trap Commonwealth: no relevant fisheries.
Exclusionary/Cautionary Zone:	A 4000 m radius Operational Area will apply around each well. This includes a temporary 500 m petroleum safety zone (exclusion zone).
Vessels:	Plugging and abandonment activities are planned to be undertaken from a moored MODU. An Inspection, Maintenance and Repair (IMR) or Anchor Handling Tug vessel will be mobilised prior to the MODU campaign to clean the Xmas trees and may be used to remove the infrastructure. Cutting and recovery of wellheads and Xmas trees will most likely be undertaken by an IMR vessel, but may be removed using the MODU and a support vessel. General support vessels for transporting equipment and materials to and from the Operational Area, and for general re-supply and support, may also be utilised.

Balnaves Well Locations:

Subsea Wells	Water Depth (m)	Latitude	Longitude	Exclusion Zones	Permit Area
			Production Wells		
BAL-5H	135 m	20° 04’ 14.438’’S	115° 11’ 00.267’’E	Temporary 500 m radius	WA-49-L

Subsea Wells	Water Depth (m)	Latitude	Longitude	Exclusion Zones	Permit Area
BAL-6H	135 m	20° 04’ 12.639’’S	115° 11’ 00.641”E	Temporary 500 m radius	WA-49-L
			Water Injection Wells		
BAL-7WI	135 m	20° 04’ 12.867’’S	115° 11’ 01.550’’E	Temporary 500 m radius	WA-49-L
			Gas Injection Wells		

Potential risks to commercial fishing and proposed mitigation measures:

Potential Risk	Risk Description	Mitigation And / Or Management Measures
Planned		
Physical presence of infrastructure on seafloor causing interference or displacement	Physical presence of infrastructure on the seafloor causing temporary interference / displacement	Wellhead location marked on marine charts Wellheads planned to be removed as part of plugging and abandonment
Underwater noise	Noise will be generated by project vessels	Due to the low acoustic source levels associated with vessel operations there is not likely to be any interaction or potential impact to fish hearing, feeding or spawning
Marine discharges	Discharges from the operation of project vessels may include sewage, grey water, drain and bilge 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	All routine marine discharges will be managed according to legislative and regulatory requirements and Woodside’s Environmental Performance Standards where applicable
Seabed disturbance	Disturbance to the seabed from plugging and abandonment, and removal activities	MODU mooring analysis, anchor deployment, if required, in accordance with Woodside standards. Logging/retrieval of wet-stored items. No anchoring of support vessels.
Vessel interaction	The presence of vessels may preclude other marine users from access to the area	Navigation aids and practices will be used as required by Maritime Regulations to minimise potential impact on other marine users. Notification to 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 A 500 m radius petroleum safety zone (temporary exclusion zone) around the MODU and vessel undertaking the activity for the duration of activities A 4000 m radius Operational Area around each well Commercial fishers and other marine users are permitted to use but should take care when entering the Operational Area
Unplanned Risks		
Hydrocarbon release	Loss of hydrocarbons to the marine environment from a well or vessel collision resulting in a tank rupture.	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
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

Feedback:

If you have any issues or concerns with these activities, any other issues relevant to this location then please respond to Woodside at:

Feedback@woodside.com.au or [redacted]

Your feedback and our response will be included in our Environment Plans which will be submitted to 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).

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 9 April 2021.

Regards

Graduate Corporate Affairs Advisor | Operations

1.17 Email sent to Australian Southern Bluefin Tuna Industry Association (23 March 2021)

Dear Australian Southern Bluefin Tuna Industry Association

Woodside is planning to submit an Environment Plan for the Plugging and Abandonment of 4 Balnaves wells around 169 km north west of Dampier, in permit area WA-49-L.

The activity is planned to commence during 2022 and completed by the end of 2024 in water depths around 135 m.

A temporary 500 m exclusion zone will apply around the Mobile Offshore Drilling Unit (MODU) and vessel undertaking the activity.

We have identified potential impacts to active commercial fishers and the environment, which are summarised below. We have endeavoured to reduce these risks to an as low as reasonably practicable level.

An information sheet (also on our website), and a map of relevant fisheries is attached.

Fisheries have been identified as being relevant based on fishing licence overlap with the activity area, assessment of government fishing effort data (including Fishcube and AFMA) from recent years, fishing methods and water depth.

Activity:

Summary:	Plug and abandonment of 4 Balnaves wells; and removal of subsea infrastructure including Xmas trees and wellheads.
Location:	169 km north-west of Dampier
Approx. Water Depth (m):	~ 135 m
Schedule:	Commencement in 2022 and completion by end 2024
Duration:	~ 20 - 60 days per well to permanently plug the wells, ~ 7 days for Xmas tree cleaning, and ~ 2 – 5 days for infrastructure removal per Xmas tree and wellhead. Activities occur 24 hours per day, 365 days per year.
Relevant State Fisheries	State: Pilbara Demersal Scalefish Fisheries – Pilbara Line and Pilbara Trap Commonwealth: no relevant fisheries.
Exclusionary/Cautionary Zone:	A 4000 m radius Operational Area will apply around each well. This includes a temporary 500 m petroleum safety zone (exclusion zone).
Vessels:	Plugging and abandonment activities are planned to be undertaken from a moored MODU. An Inspection, Maintenance and Repair (IMR) or Anchor Handling Tug vessel will be mobilised prior to the MODU campaign to clean the Xmas trees and may be used to remove the infrastructure. Cutting and recovery of wellheads and Xmas trees will most likely be undertaken by an IMR vessel, but may be removed using the MODU and a support vessel. General support vessels for transporting equipment and materials to and from the Operational Area, and for general re-supply and support, may also be utilised.

Balnaves Well Locations:

Subsea Wells	Water Depth (m)	Latitude	Longitude	Exclusion Zones	Permit Area
			Production Wells		
BAL-5H	135 m	20° 04’ 14.438’’S	115° 11’ 00.267’’E	Temporary 500 m radius	WA-49-L
BAL-6H	135 m	20° 04’ 12.639’’S	115° 11’ 00.641”E	Temporary 500 m radius	WA-49-L
			Water Injection Wells		
BAL-7WI	135 m	20° 04’ 12.867’’S	115° 11’ 01.550’’E	Temporary 500 m radius	WA-49-L
			Gas Injection Wells		

Potential risks to commercial fishing and proposed mitigation measures:

Potential Risk	Risk Description	Mitigation And / Or Management Measures
Planned		
Physical presence of infrastructure on seafloor causing interference or displacement	Physical presence of infrastructure on the seafloor causing temporary interference / displacement	Wellhead location marked on marine charts Wellheads planned to be removed as part of plugging and abandonment
Underwater noise	Noise will be generated by project vessels	Due to the low acoustic source levels associated with vessel operations there is not likely to be any interaction or potential impact to fish hearing, feeding or spawning
Marine discharges	Discharges from the operation of project vessels may include sewage, grey water, drain and bilge 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	All routine marine discharges will be managed according to legislative and regulatory requirements and Woodside’s Environmental Performance Standards where applicable
Seabed disturbance	Disturbance to the seabed from plugging and abandonment, and removal activities	MODU mooring analysis, anchor deployment, if required, in accordance with Woodside standards. Logging/retrieval of wet-stored items. No anchoring of support vessels.
Vessel interaction	The presence of vessels may preclude other marine users from access to the area	Navigation aids and practices will be used as required by Maritime Regulations to minimise potential impact on other marine users.

		Notification to 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 A 500 m radius petroleum safety zone (temporary exclusion zone) around the MODU and vessel undertaking the activity for the duration of activities A 4000 m radius Operational Area around each well Commercial fishers and other marine users are permitted to use but should take care when entering the Operational Area
Unplanned Risks		
Hydrocarbon release	Loss of hydrocarbons to the marine environment from a well or vessel collision resulting in a tank rupture.	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
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

Feedback:
If you have any issues or concerns with these activities, any other issues relevant to this location then please respond to Woodside at:

Feedback@woodside.com.au or [redacted]

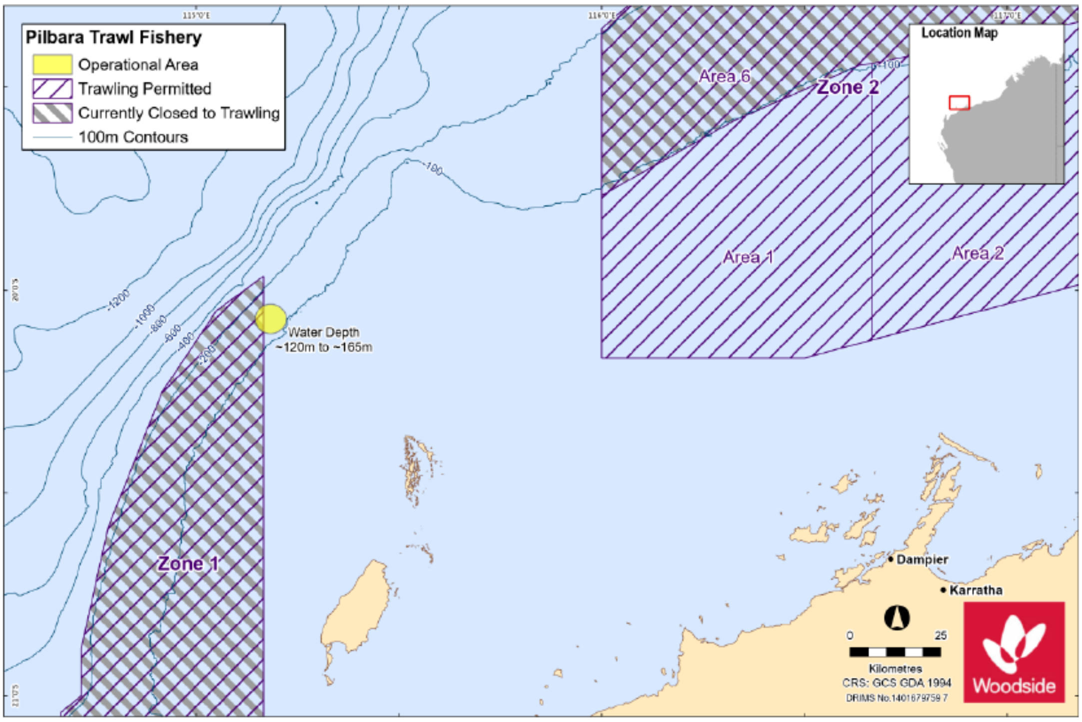
Your feedback and our response will be included in our Environment Plans which will be submitted to submitted to the National Offshore Petroleum Safety and Environmental Management Authority (NOPSEMA) for acceptance in accordance with the *Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2009* (Cth).

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.

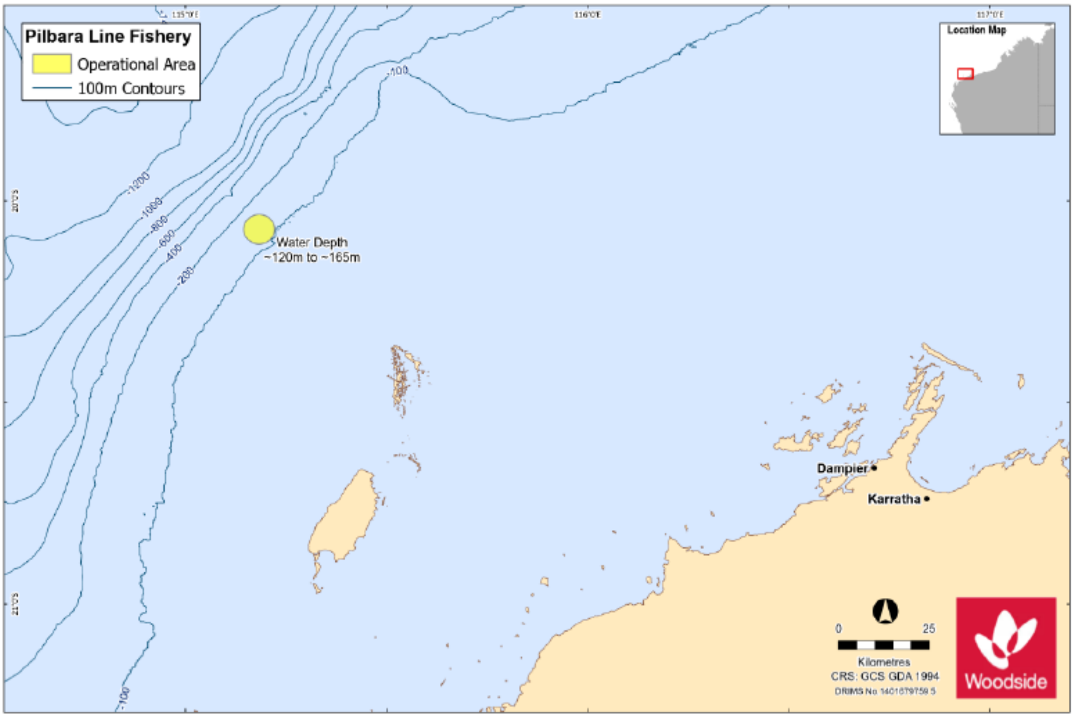
Please provide your views by 20 April 2021.
Regards
Graduate Corporate Affairs Adviser | Operations

1.18 Fisheries map sent to WAFIC (22 March 2021) and Australian Southern Bluefin Tuna Industry Association, Pilbara Line Licence Holders and Pilbara Trap Licence Holders (23 March 2021)

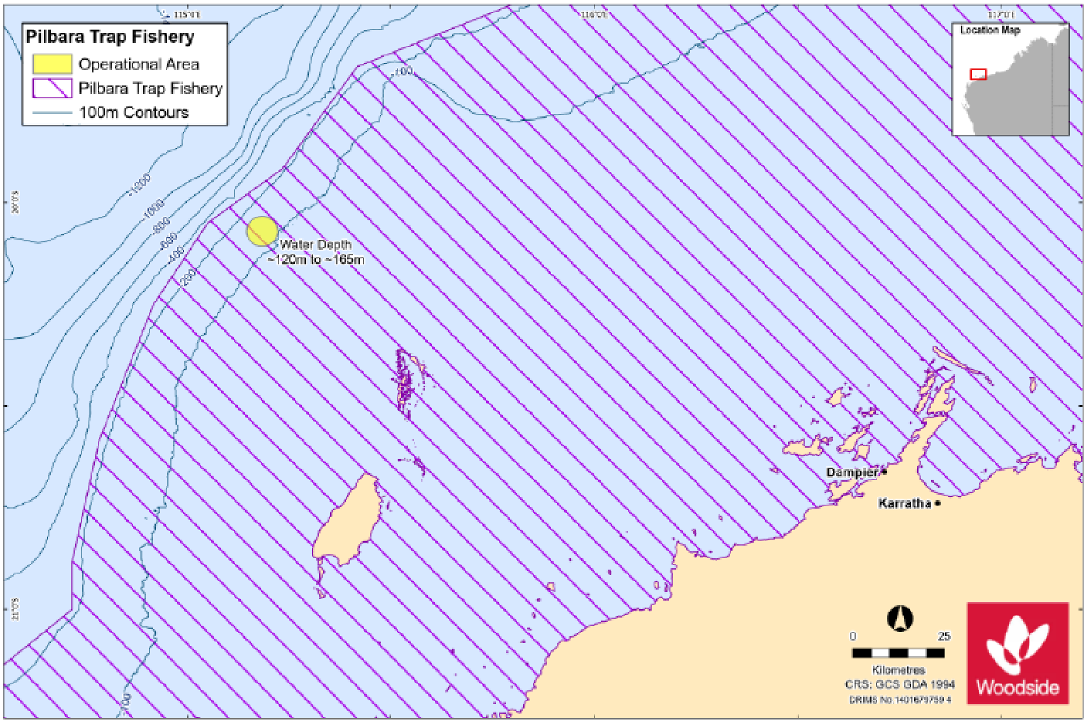
Pilbara Trawl Fishery



Pilbara Line Fishery



Pilbara Trap Fishery



1.19 Email to Pilbara Line Licence Holders (23 March 2021)

Dear Pilbara Line Licence Holder

Woodside is planning to submit an Environment Plan for the Plugging and Abandonment of 4 Balnaves wells around 169 km north west of Dampier, in permit area WA-49-L.

The activity is planned to commence during 2022 and completed by the end of 2024 in water depths around 135 m.

A temporary 500 m exclusion zone will apply around the Mobile Offshore Drilling Unit (MODU) and vessel undertaking the activity.

We have identified potential impacts to active commercial fishers and the environment, which are summarised below. We have endeavoured to reduce these risks to an as low as reasonably practicable level.

An information sheet (also on our website), and a map of relevant fisheries is attached.

Fisheries have been identified as being relevant based on fishing licence overlap with the activity area, assessment of government fishing effort data (including Fishcube and AFMA) from recent years, fishing methods and water depth.

Activity:

Summary:	Plug and abandonment of 4 Balnaves wells; and removal of subsea infrastructure including Xmas trees and wellheads.
Location:	169 km north-west of Dampier
Approx. Water Depth (m):	~ 135 m
Schedule:	Commencement in 2022 and completion by end 2024
Duration:	~ 20 - 60 days per well to permanently plug the wells, ~ 7 days for Xmas tree cleaning, and ~ 2 – 5 days for infrastructure removal per Xmas tree and wellhead. Activities occur 24 hours per day, 365 days per year.
Relevant State Fisheries	State: Pilbara Demersal Scalefish Fisheries – Pilbara Line and Pilbara Trap Commonwealth: no relevant fisheries.
Exclusionary/Cautionary Zone:	A 4000 m radius Operational Area will apply around each well. This includes a temporary 500 m petroleum safety zone (exclusion zone).
Vessels:	Plugging and abandonment activities are planned to be undertaken from a moored MODU. An Inspection, Maintenance and Repair (IMR) or Anchor Handling Tug vessel will be mobilised prior to the MODU campaign to clean the Xmas trees and may be used to remove the infrastructure. Cutting and recovery of wellheads and Xmas trees will most likely be undertaken by an IMR vessel, but may be removed using the MODU and a support vessel. General support vessels for transporting equipment and materials to and from the Operational Area, and for general re-supply and support, may also be utilised.

Balnaves Well Locations:

Subsea Wells	Water Depth (m)	Latitude	Longitude	Exclusion Zones	Permit Area
			Production Wells		
BAL-5H	135 m	20° 04' 14.438''S	115° 11' 00.267''E	Temporary 500 m radius	WA-49-L
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			Water Injection Wells		
BAL-7WI	135 m	20° 04' 12.867''S	115° 11' 01.550''E	Temporary 500 m radius	WA-49-L
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Potential risks to commercial fishing and proposed mitigation measures:

Potential Risk	Risk Description	Mitigation And / Or Management Measures
Planned		
Physical presence of infrastructure on seafloor causing interference or displacement	Physical presence of infrastructure on the seafloor causing temporary interference / displacement	Wellhead location marked on marine charts Wellheads planned to be removed as part of plugging and abandonment
Underwater noise	Noise will be generated by project vessels	Due to the low acoustic source levels associated with vessel operations there is not likely to be any interaction or potential impact to fish hearing, feeding or spawning
Marine discharges	Discharges from the operation of project vessels may include sewage, grey water, drain and bilge 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	All routine marine discharges will be managed according to legislative and regulatory requirements and Woodside's Environmental Performance Standards where applicable
Seabed disturbance	Disturbance to the seabed from plugging and abandonment, and removal activities	MODU mooring analysis, anchor deployment, if required, in accordance with Woodside standards. Logging/retrieval of wet-stored items. No anchoring of support vessels.
Vessel interaction	The presence of vessels may preclude other marine users from access to the area	Navigation aids and practices will be used as required by Maritime Regulations to minimise potential impact on other marine users.

		Notification to 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 A 500 m radius petroleum safety zone (temporary exclusion zone) around the MODU and vessel undertaking the activity for the duration of activities A 4000 m radius Operational Area around each well Commercial fishers and other marine users are permitted to use but should take care when entering the Operational Area
Unplanned Risks		
Hydrocarbon release	Loss of hydrocarbons to the marine environment from a well or vessel collision resulting in a tank rupture.	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
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

Feedback:
If you have any issues or concerns with these activities, any other issues relevant to this location then please respond to Woodside at:

Feedback@woodside.com.au or [redacted]

Your feedback and our response will be included in our Environment Plans which will be submitted to 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).

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 20 April 2021.

Regards

Graduate Corporate Affairs Adviser | Operations

1.20 Email to Pilbara Trap Licence Holders (23 March 2021)

Dear Pilbara Trap Licence Holder

Woodside is planning to submit an Environment Plan for the Plugging and Abandonment of 4 Balnaves wells around 169 km north west of Dampier, in permit area WA-49-L.

The activity is planned to commence during 2022 and completed by the end of 2024 in water depths around 135 m.

A temporary 500 m exclusion zone will apply around the Mobile Offshore Drilling Unit (MODU) and vessel undertaking the activity.

We have identified potential impacts to active commercial fishers and the environment, which are summarised below. We have endeavoured to reduce these risks to an as low as reasonably practicable level.

An information sheet (also on our website), and a map of relevant fisheries is attached.

Fisheries have been identified as being relevant based on fishing licence overlap with the activity area, assessment of government fishing effort data (including Fishcube and AFMA) from recent years, fishing methods and water depth.

Activity:

Summary:	Plug and abandonment of 4 Balnaves wells; and removal of subsea infrastructure including Xmas trees and wellheads.
Location:	169 km north-west of Dampier
Approx. Water Depth (m):	~ 135 m
Schedule:	Commencement in 2022 and completion by end 2024
Duration:	~ 20 - 60 days per well to permanently plug the wells, ~ 7 days for Xmas tree cleaning, and ~ 2 – 5 days for infrastructure removal per Xmas tree and wellhead. Activities occur 24 hours per day, 365 days per year.
Relevant State Fisheries	State: Pilbara Demersal Scalefish Fisheries – Pilbara Line and Pilbara Trap Commonwealth: no relevant fisheries.
Exclusionary/Cautionary Zone:	A 4000 m radius Operational Area will apply around each well. This includes a temporary 500 m petroleum safety zone (exclusion zone).
Vessels:	Plugging and abandonment activities are planned to be undertaken from a moored MODU. An Inspection, Maintenance and Repair (IMR) or Anchor Handling Tug vessel will be mobilised prior to the MODU campaign to clean the Xmas trees and may be used to remove the infrastructure. Cutting and recovery of wellheads and Xmas trees will most likely be undertaken by an IMR vessel, but may be removed using the MODU and a support vessel. General support vessels for transporting equipment and materials to and from the Operational Area, and for general re-supply and support, may also be utilised.

Balnaves Well Locations:

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			Water Injection Wells		
BAL-7WI	135 m	20° 04’ 12.867’’S	115° 11’ 01.550’’E	Temporary 500 m radius	WA-49-L
			Gas Injection Wells		

Potential risks to commercial fishing and proposed mitigation measures:

Potential Risk	Risk Description	Mitigation And / Or Management Measures
Planned		
Physical presence of infrastructure on seafloor causing interference or displacement	Physical presence of infrastructure on the seafloor causing temporary interference / displacement	Wellhead location marked on marine charts Wellheads planned to be removed as part of plugging and abandonment
Underwater noise	Noise will be generated by project vessels	Due to the low acoustic source levels associated with vessel operations there is not likely to be any interaction or potential impact to fish hearing, feeding or spawning
Marine discharges	Discharges from the operation of project vessels may include sewage, grey water, drain and bilge 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	All routine marine discharges will be managed according to legislative and regulatory requirements and Woodside’s Environmental Performance Standards where applicable
Seabed disturbance	Disturbance to the seabed from plugging and abandonment, and removal activities	MODU mooring analysis, anchor deployment, if required, in accordance with Woodside standards. Logging/retrieval of wet-stored items. No anchoring of support vessels.
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		dates and any exclusion zones prior to commencement of the activity A 500 m radius petroleum safety zone (temporary exclusion zone) around the MODU and vessel undertaking the activity for the duration of activities A 4000 m radius Operational Area around each well Commercial fishers and other marine users are permitted to use but should take care when entering the Operational Area
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Hydrocarbon release	Loss of hydrocarbons to the marine environment from a well or vessel collision resulting in a tank rupture.	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
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

Feedback:
If you have any issues or concerns with these activities, any other issues relevant to this location then please respond to Woodside at:

Feedback@woodside.com.au or [redacted]

Your feedback and our response will be included in our Environment Plans which will be submitted to 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).

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 20 April 2021.

Regards
Graduate Corporate Affairs Adviser | Operations

1.21 Email to Australian Maritime Safety Authority (14 May 2021)

Hello [redacted]

As part of Woodside’s ongoing consultation for its current and planned activities, I would like to advise Australian Maritime Safety Authority (AMSA) that Woodside are preparing the Balnaves Plug and Abandonment 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 website here, providing information on the proposed petroleum activities program.

The Balnaves Plug and Abandonment 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).

Woodside propose to submit an EP on 5th July 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 18th June 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.

Many thanks,

Hydrocarbon Spill Adviser

1.22 Email to Department of Transport (14 May 2021)

Dear [redacted]

As part of Woodside's ongoing consultation for its current and planned activities, I would like to advise WA Department of Transport (DoT) that Woodside are preparing the Balnaves Plug and Abandonment Environment Plan and would like to offer DoT 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 Balnaves Plug and Abandonment 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).

In the table below, as requested in the Offshore Petroleum Industry Guidance Note (July 2020) and from recent engagement activities between DoT and Woodside, responses to the information requirements in a succinct summary and source of information.

Woodside propose to submit an EP on 5th July 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 18th June 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.

Many thanks,

Hydrocarbon Spill Adviser

<table>
<tr><th></th><th></th></tr>
<tr><td>Description of activity, including the intended schedule, location (including coordinates), distance to nearest landfall and map.</td><td>Included in the consultation information sheet</td></tr>
<tr><td>Worst case spill volumes.</td><td>Included in Appendix A of the First Strike Plan</td></tr>
<tr><td>Known or indicative oil type/properties.</td><td>Included in Appendix A of the First Strike Plan</td></tr>
<tr><td>Amenability of oil to dispersants and window of opportunity for dispersant efficacy.</td><td>N/A – modelling does not predict floating oil concentrations at thresholds appropriate for dispersant application (i.e. >50 g/m2)</td></tr>
<tr><td>Description of existing environment and protection priorities.</td><td>Included in section 4 of the First Strike Plan</td></tr>
<tr><td>Details of the environmental risk assessment related to marine oil pollution - describe the process and key outcomes around risk identification, risk analysis, risk evaluation and risk treatment. For further information see the Oil Pollution Risk Management Information Paper (NOPSEMA 2017).</td><td>Unplanned loss of containment events from the Petroleum Activities Program have been identified during the risk assessment process (presented in Section 7 of the EP). Further descriptions of risk, impacts and mitigation measures (which are not related to hydrocarbon preparedness and response) are provided in Section 7 of the EP. Five unplanned events or credible spill scenarios for the Petroleum Activities Program have been selected as representative across types, sources and incident/response levels, up to and including the WCCS.
Table 2-1 of the OSPRMA presents the credible scenarios for the Petroleum Activities Program. Three WCCS for the activity have been used for response planning purposes as all other scenarios are of a lesser scale and extent. By demonstrating capability to meet and manage an event of this size and timescale, Woodside assumes relevant scenarios that are smaller in nature and scale can also be managed by the same capability.
Response performance outcomes have been defined based on a response to the WCCS.</td></tr>
<tr><td>Outcomes of oil spill trajectory modelling, including predicted times to enter State waters and contact shorelines.</td><td>
<table>
<tr><th></th><th>Credible Scenario-01
Minimum time to shoreline contact (above 100g/m2) in days</th><th>Credible Scenario-05
Minimum time to shoreline contact (above 100g/m2) in days</th></tr>
<tr><td colspan="3">Note: No shoreline locations are predicted to be impacted above the 100 g/m2 threshold. The below locations are all potentially impacted at >10 g/m2</td></tr>
<tr><td>Ningaloo Coast WHA and State Marine Park</td><td>No contact at threshold
24.8 days, 6 m3 (at 10 g/m2)</td><td>No contact at any threshold</td></tr>
<tr><td>Muiron Islands State Marine Park</td><td>No contact at threshold</td><td>No contact at any threshold</td></tr>
</table>
</td></tr>
</table>

		20.1 days, 2 m3 (at 10 g/m2)	
	Montebello Islands	No contact at threshold 8.3 days, 3 m3 (at 10 g/m2)	No contact at any threshold
	Barrow Island	No contact at threshold 8.3 days, 2 m3 (at 10 g/m2)	No contact at any threshold
	Southern Pilbara – Islands	No contact at threshold 30.5 days, <1 m3 (at 10 g/m2)	No contact at any threshold
Details on initial response actions and key activation timeframes.	Included in Section 2 and 3 of the First Strike Plan		
Potential Incident Control Centre arrangements.	Included in Appendix E and F of the First Strike Plan		
Potential staging areas / Forward Operating Base.	A Forward Operating Base can be established at Exmouth and/ or Dampier.		
Details on response strategies.	Included in Section 2 and 3 of the First Strike Plan		
Use of DoT equipment resources	Woodside has access to its own and contracted stockpiles of response equipment and acknowledges that potential use of DoT resources cannot be assumed and is at the discretion of DoT.		
Details and diagrams on proposed IMT structure including integration of DoT arrangements as per this IGN.	Included in Appendix E and F of the First Strike Plan		
Details on testing of arrangements of OPEP/OSCP.	One Level 1 oil spill response exercise to be conducted within two weeks of commencing plug and abandonment activities. The drill will test elements of the recommended response identified in the Balnaves Plug and Abandonment Oil Pollution First Strike Plan, in relation to the level of the incident. 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 the Hydrocarbon Spill Arrangements Testing Schedule (Woodside Doc No. 10058092). Woodside's Hydrocarbon Spill Preparedness & Response Testing Schedule aligns with international good practice for spill preparedness & response management; the testing is compatible with the IPIECA Good Practice Guide and the Australian Emergency Management Institute Handbook. The Hydrocarbon Spill Arrangements Testing Schedule (Woodside Doc No. 10058092) 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. This ensures that 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. This is over and above the emergency management exercises conducted.
Additional comments	Please note some of the links in the document are still being finalised, and as such may show a reference error in the attached version.

APPENDIX G DEPARTMENT OF PLANNING LAND, HERITAGE AND ABORIGINAL ENQUIRY SYSTEM RESULTS

This document is protected by copyright. No part of this document may be reproduced, adapted, transmitted, or stored in any form by any process (electronic or otherwise) without the specific written consent of Woodside. All rights are reserved.

Aboriginal Heritage Inquiry System

List of Other Heritage Places

Search Criteria

280 Other Heritage Places in Custom search area - Polygon - 113.506511182827°E, 22.5493218645815°S (GDA94) : 113.506511182827°E, 20.2840757397128°S (GDA94) : 115.610393018765°E, 20.2840757397128°S (GDA94) : 115.610393018765°E, 22.5493218645815°S (GDA94) : 113.506511182827°E, 22.5493218645815°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 AboriginalHeritage@dplh.wa.gov.au and we will make every effort to rectify it as soon as possible.

Copyright

Copyright in the information contained herein is and shall remain the property of the State of Western Australia. All rights reserved.

Coordinate Accuracy

Coordinates (Easting/Northing metres) are based on the GDA 94 Datum. Accuracy is shown as a code in brackets following the coordinates.

Terminology (NB that some terminology has varied over the life of the legislation)

Place ID/Site ID: This a unique ID assigned by the Department of Planning, Lands and Heritage to the place.
Status:

- **Registered Site**: The place has been assessed as meeting Section 5 of the *Aboriginal Heritage Act 1972.*
- **Other Heritage Place which includes:**
  - **Stored Data / Not a Site:** The place has been assessed as not meeting Section 5 of the *Aboriginal Heritage Act 1972.*
  - **Lodged:** Information has been received in relation to the place, but an assessment has not been completed at this *stage* to determine if it meets Section 5 of the *Aboriginal Heritage Act 1972.*

Access and Restrictions:

- **File Restricted = No:** Availability of information that the Department of Planning, Lands and Heritage holds in relation to the place is not restricted in any way.
- **File Restricted = Yes:** Some of the information that the Department of Planning, Lands and Heritage holds in relation to the place is restricted if it is considered culturally sensitive. This information will only be made available if the Department of Planning, Lands and Heritage receives written approval from the informants who provided the information. To request access please contact AboriginalHeritage@dplh.wa.gov.au.
- **Boundary Restricted = No:** Place location is shown as accurately as the information lodged with the Registrar allows.
- **Boundary Restricted = Yes:** To preserve confidentiality the exact location and extent of the place is not displayed on the map. However, the shaded region (generally with an area of at least 4km²) provides a general indication of where the place is located. If you are a landowner and wish to find out more about the exact location of the place, please contact the Department of Planning, Lands and Heritage.
- **Restrictions:**
  - **No Restrictions:** *Anyone* can view the information.
  - **Male Access Only:** Only *males* can view restricted information.
  - **Female Access Only:** *Only* females can view restricted information.

Legacy ID: This is the former unique number that the former Department of Aboriginal Sites assigned to the place. This has been replaced by the Place ID / Site ID.

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ID	Name	File Restricted	Boundary Restricted	Restrictions	Status	Type	Knowledge Holders	Coordinate	Legacy ID
638	LEARMONTH 1	No	No	No Gender Restrictions	Stored Data / Not a Site	Artefacts / Scatter	*Registered Knowledge Holder names available from DAA	201888mE 7558405mN Zone 50 [Reliable]	P07439
639	LEARMONTH 2	No	No	No Gender Restrictions	Stored Data / Not a Site	Artefacts / Scatter	*Registered Knowledge Holder names available from DAA	201788mE 7558355mN Zone 50 [Reliable]	P07440
780	SAPPHIRE 3	No	No	No Gender Restrictions	Stored Data / Not a Site	Artefacts / Scatter	*Registered Knowledge Holder names available from DAA	283438mE 7588055mN Zone 50 [Reliable]	P07332
781	SAPPHIRE 4	No	No	No Gender Restrictions	Stored Data / Not a Site	Artefacts / Scatter	*Registered Knowledge Holder names available from DAA	282838mE 7583355mN Zone 50 [Reliable]	P07333
809	SAPPHIRE 2	No	No	No Gender Restrictions	Stored Data / Not a Site	Artefacts / Scatter	*Registered Knowledge Holder names available from DAA	279938mE 7583155mN Zone 50 [Reliable]	P07320
810	URALA 94 A	No	No	No Gender Restrictions	Lodged	Midden / Scatter	*Registered Knowledge Holder names available from DAA	272738mE 7590655mN Zone 50 [Reliable]	P07321
883	BARROW ISLAND 01	No	No	No Gender Restrictions	Lodged	Artefacts / Scatter	*Registered Knowledge Holder names available from DAA	334950mE 7692667mN Zone 50 [Reliable]	P07291
884	BARROW ISLAND 02	No	No	No Gender Restrictions	Lodged	Artefacts / Scatter	*Registered Knowledge Holder names available from DAA	331673mE 7691987mN Zone 50 [Reliable]	P07292
885	BARROW ISLAND 03	No	No	No Gender Restrictions	Lodged	Artefacts / Scatter	*Registered Knowledge Holder names available from DAA	326224mE 7689495mN Zone 50 [Reliable]	P07293
886	BARROW ISLAND 04	No	No	No Gender Restrictions	Lodged	Artefacts / Scatter	*Registered Knowledge Holder names available from DAA	325227mE 7694610mN Zone 50 [Reliable]	P07294
887	BARROW ISLAND 05	No	No	No Gender Restrictions	Lodged	Artefacts / Scatter	*Registered Knowledge Holder names available from DAA	337603mE 7713680mN Zone 50 [Reliable]	P07295
888	BARROW ISLAND 06 A-F	No	No	No Gender Restrictions	Lodged	Artefacts / Scatter	*Registered Knowledge Holder names available from DAA	337202mE 7710824mN Zone 50 [Unreliable]	P07296

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889	BARROW ISLAND 07	No	No	No Gender Restrictions	Lodged	Artefacts / Scatter	*Registered Knowledge Holder names available from DAA	337957mE 7709368mN Zone 50 [Reliable]	P07297
890	BARROW ISLAND 08	No	No	No Gender Restrictions	Lodged	Artefacts / Scatter	*Registered Knowledge Holder names available from DAA	326487mE 7695727mN Zone 50 [Reliable]	P07298
891	BARROW ISLAND 09	No	No	No Gender Restrictions	Lodged	Artefacts / Scatter	*Registered Knowledge Holder names available from DAA	326270mE 7691185mN Zone 50 [Reliable]	P07299
892	BARROW ISLAND 10	No	No	No Gender Restrictions	Lodged	Artefacts / Scatter	*Registered Knowledge Holder names available from DAA	331892mE 7691082mN Zone 50 [Reliable]	P07300
893	BARROW ISLAND 11	No	No	No Gender Restrictions	Lodged	Artefacts / Scatter	*Registered Knowledge Holder names available from DAA	326145mE 7695108mN Zone 50 [Reliable]	P07301
894	BARROW ISLAND 12	No	No	No Gender Restrictions	Lodged	Artefacts / Scatter	*Registered Knowledge Holder names available from DAA	326347mE 7699332mN Zone 50 [Reliable]	P07302
5950	AMBER 2	No	No	No Gender Restrictions	Stored Data / Not a Site	Artefacts / Scatter	*Registered Knowledge Holder names available from DAA	303739mE 7592555mN Zone 50 [Reliable]	P07157
5956	GRIFFIN GAS 06	No	No	No Gender Restrictions	Stored Data / Not a Site	Artefacts / Scatter, Midden / Scatter	*Registered Knowledge Holder names available from DAA	281938mE 7590855mN Zone 50 [Reliable]	P07164
5957	GRIFFIN GAS 07	No	No	No Gender Restrictions	Stored Data / Not a Site	Midden / Scatter	*Registered Knowledge Holder names available from DAA	282338mE 7591705mN Zone 50 [Reliable]	P07165
5958	GRIFFIN GAS 08	No	No	No Gender Restrictions	Stored Data / Not a Site	Artefacts / Scatter	*Registered Knowledge Holder names available from DAA	283538mE 7592355mN Zone 50 [Reliable]	P07166
5959	GRIFFIN GAS 09	No	No	No Gender Restrictions	Stored Data / Not a Site	Artefacts / Scatter, Midden / Scatter	*Registered Knowledge Holder names available from DAA	287671mE 7592681mN Zone 50 [Reliable]	P07167
5960	GRIFFIN GAS 10	No	No	No Gender Restrictions	Stored Data / Not a Site	Midden / Scatter	*Registered Knowledge Holder names available from DAA	288439mE 7592755mN Zone 50 [Reliable]	P07168

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5961	GRIFFIN GAS 11	No	No	No Gender Restrictions	Stored Data / Not a Site	Artefacts / Scatter	*Registered Knowledge Holder names available from DAA	289739mE 7592755mN Zone 50 [Reliable]	P07169
5962	GRIFFIN GAS 12	No	No	No Gender Restrictions	Stored Data / Not a Site	Artefacts / Scatter	*Registered Knowledge Holder names available from DAA	289939mE 7592755mN Zone 50 [Reliable]	P07170
5963	GRIFFIN GAS 13	No	No	No Gender Restrictions	Stored Data / Not a Site	Artefacts / Scatter	*Registered Knowledge Holder names available from DAA	291239mE 7592755mN Zone 50 [Reliable]	P07171
5964	GRIFFIN GAS 14	No	No	No Gender Restrictions	Stored Data / Not a Site	Artefacts / Scatter, Midden / Scatter	*Registered Knowledge Holder names available from DAA	292439mE 7592755mN Zone 50 [Reliable]	P07172
5965	GRIFFIN GAS 15	No	No	No Gender Restrictions	Stored Data / Not a Site	Artefacts / Scatter	*Registered Knowledge Holder names available from DAA	292572mE 7593007mN Zone 50 [Reliable]	P07173
5967	GRIFFIN GAS 17	No	No	No Gender Restrictions	Stored Data / Not a Site	Artefacts / Scatter	*Registered Knowledge Holder names available from DAA	293739mE 7592755mN Zone 50 [Reliable]	P07175
6115	EXMOUTH NORTH-EAST	No	No	No Gender Restrictions	Lodged	Skeletal Material / Burial	*Registered Knowledge Holder names available from DAA	204338mE 7572655mN Zone 50 [Reliable]	P07004
6116	EXMOUTH SOUTH-WEST	No	No	No Gender Restrictions	Lodged	Skeletal Material / Burial	*Registered Knowledge Holder names available from DAA	200638mE 7568755mN Zone 50 [Reliable]	P07005
6119	PAP HILL 1.	No	No	No Gender Restrictions	Lodged	Rockshelter	*Registered Knowledge Holder names available from DAA	198238mE 7581955mN Zone 50 [Reliable]	P07008
6120	PAP HILL 2.	No	No	No Gender Restrictions	Lodged	Grinding Patches / Grooves, Rockshelter, BP Dating: 35,230 BP	*Registered Knowledge Holder names available from DAA	198138mE 7581855mN Zone 50 [Reliable]	P07009
6312	EXMOUTH NORTH-EAST	No	No	No Gender Restrictions	Lodged	Artefacts / Scatter	*Registered Knowledge Holder names available from DAA	204300mE 7574150mN Zone 50 [Unreliable]	P06629
6524	CHINTY CREEK EAST	No	No	No Gender Restrictions	Stored Data / Not a Site	Artefacts / Scatter	*Registered Knowledge Holder names available from DAA	289439mE 7572355mN Zone 50 [Reliable]	P06421

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6525	RED DUNE SCATTER 1.	No	No	No Gender Restrictions	Lodged	Artefacts / Scatter, Shell	*Registered Knowledge Holder names available from DAA	297339mE 7557655mN Zone 50 [Reliable]	P06422
6527	RED DUNE SCATTER 3	No	No	No Gender Restrictions	Stored Data / Not a Site	Artefacts / Scatter	*Registered Knowledge Holder names available from DAA	298139mE 7555355mN Zone 50 [Reliable]	P06424
6528	WARRALEE WELL NORTH.	No	No	No Gender Restrictions	Stored Data / Not a Site	Artefacts / Scatter, Shell	*Registered Knowledge Holder names available from DAA	298439mE 7554655mN Zone 50 [Reliable]	P06425
6531	MANYARRA WELL WEST	No	No	No Gender Restrictions	Stored Data / Not a Site	Artefacts / Scatter	*Registered Knowledge Holder names available from DAA	303239mE 7546055mN Zone 50 [Reliable]	P06428
6539	WARRALEE CLAYPAN.	No	No	No Gender Restrictions	Stored Data / Not a Site	Camp, Water Source	*Registered Knowledge Holder names available from DAA	298889mE 7553805mN Zone 50 [Unreliable]	P06436
6540	ASHBURTON RIVER	Yes	Yes	No Gender Restrictions	Stored Data / Not a Site	Mythological	*Registered Knowledge Holder names available from DAA	Not available when location is restricted	P06437
6621	FOUR MILE CREEK CAMP.	Yes	Yes	No Gender Restrictions	Stored Data / Not a Site	Camp	*Registered Knowledge Holder names available from DAA	Not available when location is restricted	P06366
6783	28 MILE CREEK NORTH 2	No	No	No Gender Restrictions	Lodged	Artefacts / Scatter, Midden / Scatter	*Registered Knowledge Holder names available from DAA	795452mE 7546377mN Zone 49 [Reliable]	P06141
6786	LAKESIDE COASTAL PLAIN	No	No	No Gender Restrictions	Lodged	Artefacts / Scatter, Midden / Scatter	*Registered Knowledge Holder names available from DAA	801642mE 7560649mN Zone 49 [Unreliable]	P06144
6788	GOAT CAVE.	No	No	No Gender Restrictions	Lodged	Artefacts / Scatter, Shell	*Registered Knowledge Holder names available from DAA	804642mE 7535649mN Zone 49 [Unreliable]	P06146
6789	TURQUOISE BAY NORTH	No	No	No Gender Restrictions	Lodged	Artefacts / Scatter, Midden / Scatter	*Registered Knowledge Holder names available from DAA	798642mE 7554649mN Zone 49 [Unreliable]	P06147
6796	ROAD ALIGNMENT 4	No	No	No Gender Restrictions	Stored Data / Not a Site	Artefacts / Scatter	*Registered Knowledge Holder names available from DAA	792442mE 7533369mN Zone 49 [Reliable]	P06154

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7060	URALA	No	No	No Gender Restrictions	Stored Data / Not a Site	Artefacts / Scatter	*Registered Knowledge Holder names available from DAA	280638mE 7588655mN Zone 50 [Unreliable]	P05891
7061	URALA MIDDEN 4	No	No	No Gender Restrictions	Stored Data / Not a Site	Artefacts / Scatter, Midden / Scatter	*Registered Knowledge Holder names available from DAA	279338mE 7589855mN Zone 50 [Reliable]	P05892
7208	MILYERING ROCKS.	No	No	No Gender Restrictions	Lodged	Hunting Place	*Registered Knowledge Holder names available from DAA	800842mE 7560649mN Zone 49 [Reliable]	P05712
7302	CAMP 17 CREEK ROCKSHELTERS	No	No	No Gender Restrictions	Lodged	Artefacts / Scatter	*Registered Knowledge Holder names available from DAA	800042mE 7555249mN Zone 49 [Unreliable]	P05648
7333	URALA STATION 13	No	No	No Gender Restrictions	Lodged	Artefacts / Scatter, Midden / Scatter	*Registered Knowledge Holder names available from DAA	281638mE 7597155mN Zone 50 [Reliable]	P05575
7366	CHINTY POOL	No	No	No Gender Restrictions	Lodged	Artefacts / Scatter	*Registered Knowledge Holder names available from DAA	276338mE 7577955mN Zone 50 [Reliable]	P05554
7367	WYLOO DAM	No	No	No Gender Restrictions	Lodged	Artefacts / Scatter	*Registered Knowledge Holder names available from DAA	283338mE 7579755mN Zone 50 [Reliable]	P05555
7368	TEN MILE POOL 1	No	No	No Gender Restrictions	Lodged	Artefacts / Scatter, Grinding Patches / Grooves	*Registered Knowledge Holder names available from DAA	287938mE 7579655mN Zone 50 [Reliable]	P05556
7369	TEN MILE POOL 2	No	No	No Gender Restrictions	Lodged	Artefacts / Scatter, Grinding Patches / Grooves	*Registered Knowledge Holder names available from DAA	289039mE 7579655mN Zone 50 [Reliable]	P05557
7370	TEN MILE POOL 3.	No	No	No Gender Restrictions	Lodged	Artefacts / Scatter, Grinding Patches / Grooves, Camp	*Registered Knowledge Holder names available from DAA	290939mE 7580055mN Zone 50 [Reliable]	P05558
7375	URALA STATION 03	No	No	No Gender Restrictions	Stored Data / Not a Site	Artefacts / Scatter, Midden / Scatter	*Registered Knowledge Holder names available from DAA	282338mE 7591455mN Zone 50 [Reliable]	P05563
7376	URALA STATION 04	No	No	No Gender Restrictions	Stored Data / Not a Site	Artefacts / Scatter, Midden / Scatter	*Registered Knowledge Holder names available from DAA	282638mE 7591655mN Zone 50 [Reliable]	P05564

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7377	URALA STATION 05	No	No	No Gender Restrictions	Lodged	Artefacts / Scatter, Midden / Scatter	*Registered Knowledge Holder names available from DAA	282738mE 7594655mN Zone 50 [Reliable]	P05565
7378	URALA STATION 06	No	No	No Gender Restrictions	Lodged	Midden / Scatter	*Registered Knowledge Holder names available from DAA	284438mE 7595755mN Zone 50 [Reliable]	P05566
7380	URALA STATION 08	No	No	No Gender Restrictions	Lodged	Midden / Scatter	*Registered Knowledge Holder names available from DAA	282538mE 7597755mN Zone 50 [Reliable]	P05568
7408	CLAYPAN WELL 2	No	No	No Gender Restrictions	Stored Data / Not a Site	Artefacts / Scatter	*Registered Knowledge Holder names available from DAA	342822mE 7557558mN Zone 50 [Reliable]	P05542
7411	CLAYPANS	No	No	No Gender Restrictions	Stored Data / Not a Site	Artefacts / Scatter, Grinding Patches / Grooves	*Registered Knowledge Holder names available from DAA	301606mE 7589758mN Zone 50 [Reliable]	P05545
7556	BORROW AREA 3-1	No	No	No Gender Restrictions	Lodged	Grinding Patches / Grooves	*Registered Knowledge Holder names available from DAA	330839mE 7511355mN Zone 50 [Reliable]	P05370
7792	COMPRESSOR STATION 2	No	No	No Gender Restrictions	Lodged	Artefacts / Scatter	*Registered Knowledge Holder names available from DAA	321639mE 7513155mN Zone 50 [Reliable]	P05129
8266	PEEPINGEE GRANITES	No	No	No Gender Restrictions	Lodged		*Registered Knowledge Holder names available from DAA	318639mE 7523655mN Zone 50 [Unreliable]	P04373
8267	JIBIA/JAMINU POOL.	No	No	No Gender Restrictions	Stored Data / Not a Site	Camp, Water Source	*Registered Knowledge Holder names available from DAA	310739mE 7537855mN Zone 50 [Reliable]	P04374
8268	KATRI.	No	No	No Gender Restrictions	Lodged	Camp, Water Source	*Registered Knowledge Holder names available from DAA	296238mE 7562234mN Zone 50 [Unreliable]	P04375
8274	NATGAS 247	No	No	No Gender Restrictions	Lodged	Artefacts / Scatter	*Registered Knowledge Holder names available from DAA	323539mE 7505454mN Zone 50 [Reliable]	P04385
8275	NATGAS 248	No	No	No Gender Restrictions	Lodged	Artefacts / Scatter	*Registered Knowledge Holder names available from DAA	320939mE 7508154mN Zone 50 [Reliable]	P04386

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8276	NATGAS 249	No	No	No Gender Restrictions	Stored Data / Not a Site	Artefacts / Scatter	*Registered Knowledge Holder names available from DAA	318639mE 7512655mN Zone 50 [Reliable]	P04387
8277	NATGAS 250	No	No	No Gender Restrictions	Stored Data / Not a Site	Artefacts / Scatter	*Registered Knowledge Holder names available from DAA	318739mE 7513055mN Zone 50 [Reliable]	P04388
8278	NATGAS 251	No	No	No Gender Restrictions	Lodged	Artefacts / Scatter	*Registered Knowledge Holder names available from DAA	319939mE 7513955mN Zone 50 [Reliable]	P04389
8279	NATGAS 252	No	No	No Gender Restrictions	Lodged	Artefacts / Scatter	*Registered Knowledge Holder names available from DAA	332239mE 7536255mN Zone 50 [Reliable]	P04390
8309	CROW PLAIN ALLUVIAL SCATTER	No	No	No Gender Restrictions	Stored Data / Not a Site	Artefacts / Scatter	*Registered Knowledge Holder names available from DAA	313207mE 7518432mN Zone 50 [Reliable]	P04361
8318	WHISKEY POOL.	No	No	No Gender Restrictions	Lodged	Ceremonial, Camp, Meeting Place	*Registered Knowledge Holder names available from DAA	323639mE 7507354mN Zone 50 [Unreliable]	P04370
8904	NATGAS 148	No	No	No Gender Restrictions	Lodged	Artefacts / Scatter	*Registered Knowledge Holder names available from DAA	316639mE 7508654mN Zone 50 [Reliable]	P03602
8905	NATGAS 149	No	No	No Gender Restrictions	Lodged	Artefacts / Scatter	*Registered Knowledge Holder names available from DAA	316839mE 7509555mN Zone 50 [Reliable]	P03603
8906	NATGAS 150	No	No	No Gender Restrictions	Lodged	Artefacts / Scatter	*Registered Knowledge Holder names available from DAA	317439mE 7509955mN Zone 50 [Reliable]	P03604
8908	NATGAS 152	No	No	No Gender Restrictions	Stored Data / Not a Site	Artefacts / Scatter	*Registered Knowledge Holder names available from DAA	319039mE 7513555mN Zone 50 [Reliable]	P03606
8909	NATGAS 153	No	No	No Gender Restrictions	Stored Data / Not a Site	Artefacts / Scatter	*Registered Knowledge Holder names available from DAA	322239mE 7519155mN Zone 50 [Reliable]	P03607
8910	NATGAS 154	No	No	No Gender Restrictions	Lodged	Artefacts / Scatter	*Registered Knowledge Holder names available from DAA	342617mE 7558008mN Zone 50 [Reliable]	P03608

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8946	YARDIE CREEK	No	No	No Gender Restrictions	Lodged	Artefacts / Scatter	*Registered Knowledge Holder names available from DAA	790842mE 7527849mN Zone 49 [Reliable]	P03537
8951	BARROW ISLAND	No	No	No Gender Restrictions	Stored Data / Not a Site	Artefacts / Scatter	*Registered Knowledge Holder names available from DAA	335137mE 7705156mN Zone 50 [Unreliable]	P03542
10496	GAS PIPELINE 53	No	No	No Gender Restrictions	Lodged	Artefacts / Scatter	*Registered Knowledge Holder names available from DAA	320639mE 7518655mN Zone 50 [Unreliable]	P01656
10497	GAS PIPELINE 54	No	No	No Gender Restrictions	Lodged	Artefacts / Scatter	*Registered Knowledge Holder names available from DAA	320639mE 7518655mN Zone 50 [Unreliable]	P01657
10498	GAS PIPELINE 55	No	No	No Gender Restrictions	Lodged	Artefacts / Scatter	*Registered Knowledge Holder names available from DAA	320639mE 7518655mN Zone 50 [Unreliable]	P01658
10499	GAS PIPELINE 56	No	No	No Gender Restrictions	Lodged	Artefacts / Scatter	*Registered Knowledge Holder names available from DAA	321639mE 7517655mN Zone 50 [Unreliable]	P01659
10500	GAS PIPELINE 57	No	No	No Gender Restrictions	Lodged	Artefacts / Scatter, Grinding Patches / Grooves	*Registered Knowledge Holder names available from DAA	321639mE 7517655mN Zone 50 [Unreliable]	P01660
10501	GAS PIPELINE 58	No	No	No Gender Restrictions	Lodged	Artefacts / Scatter	*Registered Knowledge Holder names available from DAA	320639mE 7516655mN Zone 50 [Unreliable]	P01661
10540	GAS PIPELINE 43	No	No	No Gender Restrictions	Lodged	Artefacts / Scatter, Midden / Scatter	*Registered Knowledge Holder names available from DAA	350138mE 7568454mN Zone 50 [Unreliable]	P01646
10541	GAS PIPELINE 44	No	No	No Gender Restrictions	Lodged	Artefacts / Scatter	*Registered Knowledge Holder names available from DAA	348239mE 7562755mN Zone 50 [Unreliable]	P01647
10542	GAS PIPELINE 45	No	No	No Gender Restrictions	Lodged	Artefacts / Scatter	*Registered Knowledge Holder names available from DAA	335639mE 7544655mN Zone 50 [Unreliable]	P01648
10547	GAS PIPELINE 50	No	No	No Gender Restrictions	Lodged	Artefacts / Scatter	*Registered Knowledge Holder names available from DAA	326639mE 7525655mN Zone 50 [Unreliable]	P01653

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11060	ROUGH RANGE	No	No	No Gender Restrictions	Lodged	Artefacts / Scatter	*Registered Knowledge Holder names available from DAA	193638mE 7504655mN Zone 50 [Unreliable]	P01106
11061	BILLY WELLS.	No	No	No Gender Restrictions	Lodged	Ceremonial, Water Source	*Registered Knowledge Holder names available from DAA	194638mE 7523655mN Zone 50 [Unreliable]	P01107
11062	KURT ISLAND	No	No	No Gender Restrictions	Lodged	Man-Made Structure	*Registered Knowledge Holder names available from DAA	245612mE 7552077mN Zone 50 [Unreliable]	P01108
11075	NANUTARRA STATION	No	No	No Gender Restrictions	Lodged		*Registered Knowledge Holder names available from DAA	344639mE 7507655mN Zone 50 [Unreliable]	P01121
11077	NANUTARRA MILL	Yes	Yes	No Gender Restrictions	Lodged	Repository / Cache	*Registered Knowledge Holder names available from DAA	Not available when location is restricted	P01123
11403	THEVENARD ISLAND	No	No	No Gender Restrictions	Lodged	Midden / Scatter	*Registered Knowledge Holder names available from DAA	292638mE 7625655mN Zone 50 [Unreliable]	P00753
11463	NORTH WEST CAPE	No	No	No Gender Restrictions	Lodged	Artefacts / Scatter, Camp	*Registered Knowledge Holder names available from DAA	807642mE 7528649mN Zone 49 [Unreliable]	P00706
11801	COASTAL MIDDEN, 5 MILE	No	No	No Gender Restrictions	Lodged	Artefacts / Scatter, Midden / Scatter	*Registered Knowledge Holder names available from DAA	195638mE 7582655mN Zone 50 [Unreliable]	P00345
11886	GASTON WELL.	Yes	Yes	No Gender Restrictions	Lodged	Artefacts / Scatter, Man-Made Structure, Quarry, Arch Deposit, Other: ?	*Registered Knowledge Holder names available from DAA	Not available when location is restricted	P00268
15306	WYLOO DAM 01	No	No	No Gender Restrictions	Lodged	Artefacts / Scatter	*Registered Knowledge Holder names available from DAA	283588mE 7584385mN Zone 50 [Reliable]	P07906
15307	WYLOO DAM 02	No	No	No Gender Restrictions	Stored Data / Not a Site	Artefacts / Scatter	*Registered Knowledge Holder names available from DAA	284823mE 7583080mN Zone 50 [Reliable]	P07907
15308	WYLOO DAM 03	No	No	No Gender Restrictions	Lodged	Artefacts / Scatter	*Registered Knowledge Holder names available from DAA	283738mE 7583155mN Zone 50 [Reliable]	P07908

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15309	WYLOO DAM 04	No	No	No Gender Restrictions	Stored Data / Not a Site	Artefacts / Scatter	*Registered Knowledge Holder names available from DAA	280641mE 7581867mN Zone 50 [Reliable]	P07909
15312	WYLOO DAM 07	No	No	No Gender Restrictions	Lodged	Artefacts / Scatter	*Registered Knowledge Holder names available from DAA	283353mE 7585065mN Zone 50 [Reliable]	P07912
15313	WYLOO DAM 08	No	No	No Gender Restrictions	Stored Data / Not a Site	Artefacts / Scatter	*Registered Knowledge Holder names available from DAA	282169mE 7583033mN Zone 50 [Reliable]	P07913
15315	WYLOO DAM 10	No	No	No Gender Restrictions	Stored Data / Not a Site	Artefacts / Scatter	*Registered Knowledge Holder names available from DAA	284173mE 7583739mN Zone 50 [Reliable]	P07915
15845	AMETHYST 04	No	No	No Gender Restrictions	Stored Data / Not a Site	Midden / Scatter	*Registered Knowledge Holder names available from DAA	295640mE 7591656mN Zone 50 [Reliable]	
15848	AMETHYST 07	No	No	No Gender Restrictions	Stored Data / Not a Site	Midden / Scatter	*Registered Knowledge Holder names available from DAA	292939mE 7597935mN Zone 50 [Reliable]	
18029	Pipeline Corridor 36 (PC-36)	No	No	No Gender Restrictions	Stored Data / Not a Site	Artefacts / Scatter	*Registered Knowledge Holder names available from DAA	338531mE 7548069mN Zone 50 [Reliable]	
19838	Midden Site at Exmouth River mouth	No	No	No Gender Restrictions	Lodged	Artefacts / Scatter, Midden / Scatter	*Registered Knowledge Holder names available from DAA	203751mE 7567075mN Zone 50 [Reliable]	
19839	Waterhole, Exmouth	No	No	No Gender Restrictions	Lodged	Artefacts / Scatter, Water Source	*Registered Knowledge Holder names available from DAA	203301mE 7572574mN Zone 50 [Reliable]	
20828	Ashburton Fencing Programme Isolated Artefacts	No	No	No Gender Restrictions	Stored Data / Not a Site	Other: Isolated Artefacts	*Registered Knowledge Holder names available from DAA	335299mE 7564224mN Zone 50 [Unreliable]	
21383	Mowbowra Creek Isolated Finds	No	No	No Gender Restrictions	Stored Data / Not a Site	Artefacts / Scatter, Rockshelter, Other: Mulitple Isolated Finds	*Registered Knowledge Holder names available from DAA	198635mE 7564321mN Zone 50 [Unreliable]	
21468	Sandy Point Rockshelter	No	No	No Gender Restrictions	Lodged	Man-Made Structure, Rockshelter, Arch Deposit, Shell	*Registered Knowledge Holder names available from DAA	786694mE 7521436mN Zone 49 [Reliable]	

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22943	Flacourt Bay 01	No	No	No Gender Restrictions	Lodged	Rockshelter	*Registered Knowledge Holder names available from DAA	331540mE 7705613mN Zone 50 [Reliable]	
24401	OS06-01	No	No	No Gender Restrictions	Lodged	Artefacts / Scatter, Midden / Scatter, Arch Deposit, Shell	*Registered Knowledge Holder names available from DAA	303859mE 7605047mN Zone 50 [Reliable]	
24421	Turtle 1	No	No	No Gender Restrictions	Lodged	Grinding Patches / Grooves, Water Source	*Registered Knowledge Holder names available from DAA	335651mE 7545012mN Zone 50 [Reliable]	
24425	Mt Minnie 1	No	No	No Gender Restrictions	Lodged	Artefacts / Scatter, Grinding Patches / Grooves, Camp	*Registered Knowledge Holder names available from DAA	337667mE 7563006mN Zone 50 [Reliable]	
24426	Mt Minnie 2	No	No	No Gender Restrictions	Lodged	Artefacts / Scatter, Grinding Patches / Grooves, Camp, Named Place	*Registered Knowledge Holder names available from DAA	338241mE 7562727mN Zone 50 [Reliable]	
24427	Mt Minnie 3	No	No	No Gender Restrictions	Lodged	Artefacts / Scatter, Camp	*Registered Knowledge Holder names available from DAA	334606mE 7561851mN Zone 50 [Reliable]	
24768	OWS07-01	No	No	No Gender Restrictions	Lodged	Midden / Scatter, Shell	*Registered Knowledge Holder names available from DAA	301869mE 7603863mN Zone 50 [Reliable]	
24769	OWS07-02	No	No	No Gender Restrictions	Lodged	Midden / Scatter, Shell	*Registered Knowledge Holder names available from DAA	301768mE 7603841mN Zone 50 [Reliable]	
24770	OWS07-03	No	No	No Gender Restrictions	Lodged	Midden / Scatter, Shell	*Registered Knowledge Holder names available from DAA	302289mE 7604030mN Zone 50 [Reliable]	
24771	OWS07-04	No	No	No Gender Restrictions	Lodged	Midden / Scatter, Shell	*Registered Knowledge Holder names available from DAA	302341mE 7604030mN Zone 50 [Reliable]	
24772	OWS07-05	No	No	No Gender Restrictions	Lodged	Midden / Scatter, Shell	*Registered Knowledge Holder names available from DAA	302258mE 7603764mN Zone 50 [Reliable]	
24773	OWS07-06	No	No	No Gender Restrictions	Lodged	Midden / Scatter, Shell	*Registered Knowledge Holder names available from DAA	302120mE 7604005mN Zone 50 [Reliable]	

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24774	OWS07-07	No	No	No Gender Restrictions	Lodged	Midden / Scatter, Shell	*Registered Knowledge Holder names available from DAA	302132mE 7604013mN Zone 50 [Reliable]	
24775	OWS07-08	No	No	No Gender Restrictions	Lodged	Midden / Scatter, Shell	*Registered Knowledge Holder names available from DAA	301768mE 7603756mN Zone 50 [Reliable]	
24776	OWS07-09	No	No	No Gender Restrictions	Lodged	Midden / Scatter, Shell	*Registered Knowledge Holder names available from DAA	301605mE 7603327mN Zone 50 [Reliable]	
24777	OWS07-10	No	No	No Gender Restrictions	Lodged	Midden / Scatter, Shell	*Registered Knowledge Holder names available from DAA	301674mE 7603389mN Zone 50 [Reliable]	
24778	OWS07-11	No	No	No Gender Restrictions	Lodged	Midden / Scatter, Shell	*Registered Knowledge Holder names available from DAA	301717mE 7603447mN Zone 50 [Reliable]	
24779	OWS07-12	No	No	No Gender Restrictions	Lodged	Midden / Scatter, Shell	*Registered Knowledge Holder names available from DAA	301763mE 7603478mN Zone 50 [Reliable]	
24780	OWS07-13	No	No	No Gender Restrictions	Lodged	Midden / Scatter, Shell	*Registered Knowledge Holder names available from DAA	301745mE 7603545mN Zone 50 [Reliable]	
24781	OWS07-14	No	No	No Gender Restrictions	Lodged	Midden / Scatter, Shell	*Registered Knowledge Holder names available from DAA	301561mE 7603573mN Zone 50 [Reliable]	
24782	CR07-01	No	No	No Gender Restrictions	Lodged	Man-Made Structure	*Registered Knowledge Holder names available from DAA	333610mE 7599115mN Zone 50 [Reliable]	
24783	CR07-02	No	No	No Gender Restrictions	Lodged	Man-Made Structure	*Registered Knowledge Holder names available from DAA	333606mE 7599128mN Zone 50 [Reliable]	
24784	CR07-03	No	No	No Gender Restrictions	Lodged	Artefacts / Scatter	*Registered Knowledge Holder names available from DAA	333818mE 7598995mN Zone 50 [Reliable]	
26110	Area 51 No 1	No	No	No Gender Restrictions	Lodged	Artefacts / Scatter, Camp	*Registered Knowledge Holder names available from DAA	336737mE 7544434mN Zone 50 [Reliable]	

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26259	Field Site 1	No	No	No Gender Restrictions	Lodged	Artefacts / Scatter, Shell	*Registered Knowledge Holder names available from DAA	201953mE 7535544mN Zone 50 [Reliable]	
26260	Field Site 2	No	No	No Gender Restrictions	Lodged	Artefacts / Scatter, Shell	*Registered Knowledge Holder names available from DAA	202340mE 7536319mN Zone 50 [Reliable]	
26261	Field Site 3	No	No	No Gender Restrictions	Lodged	Artefacts / Scatter, Shell	*Registered Knowledge Holder names available from DAA	201142mE 7535288mN Zone 50 [Reliable]	
26268	CSF Isolated Find	No	No	No Gender Restrictions	Lodged	Other: 3 Isolated artefacts.	*Registered Knowledge Holder names available from DAA	202134mE 7535834mN Zone 50 [Unreliable]	
26992	Calliance 1	No	No	No Gender Restrictions	Lodged	Artefacts / Scatter, Camp	*Registered Knowledge Holder names available from DAA	338797mE 7562176mN Zone 50 [Reliable]	
26993	Calliance 2	No	No	No Gender Restrictions	Lodged	Artefacts / Scatter, Camp	*Registered Knowledge Holder names available from DAA	339325mE 7561427mN Zone 50 [Reliable]	
26994	Calliance 3	No	No	No Gender Restrictions	Lodged	Artefacts / Scatter, Camp	*Registered Knowledge Holder names available from DAA	339480mE 7561440mN Zone 50 [Reliable]	
26995	Calliance 4	No	No	No Gender Restrictions	Lodged	Artefacts / Scatter, Camp	*Registered Knowledge Holder names available from DAA	341185mE 7561791mN Zone 50 [Reliable]	
26996	Calliance 5	No	No	No Gender Restrictions	Lodged	Artefacts / Scatter, Camp	*Registered Knowledge Holder names available from DAA	340072mE 7560989mN Zone 50 [Reliable]	
26997	Calliance 6	No	No	No Gender Restrictions	Stored Data / Not a Site	Artefacts / Scatter, Camp	*Registered Knowledge Holder names available from DAA	339772mE 7560863mN Zone 50 [Reliable]	
27618	Skyrne Hill 1	No	No	No Gender Restrictions	Lodged	Artefacts / Scatter, Grinding Patches / Grooves, Camp	*Registered Knowledge Holder names available from DAA	329911mE 7552343mN Zone 50 [Reliable]	
27619	Skyrne Hill 2	No	No	No Gender Restrictions	Lodged	Artefacts / Scatter, Grinding Patches / Grooves, Camp	*Registered Knowledge Holder names available from DAA	328300mE 7550909mN Zone 50 [Reliable]	

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ID	Name	File Restricted	Boundary Restricted	Restrictions	Status	Type	Knowledge Holders	Coordinate	Legacy ID
27620	Skyrne Hill 3	No	No	No Gender Restrictions	Lodged	Artefacts / Scatter, Grinding Patches / Grooves, Camp	*Registered Knowledge Holder names available from DAA	330912mE 7548982mN Zone 50 [Reliable]	
27621	Skyrne Hill 4	No	No	No Gender Restrictions	Lodged	Artefacts / Scatter, Grinding Patches / Grooves, Camp	*Registered Knowledge Holder names available from DAA	330941mE 7548991mN Zone 50 [Reliable]	
27626	Skyrne Hill Isolated Finds	No	No	No Gender Restrictions	Lodged	Other: 20 Isolated artefacts	*Registered Knowledge Holder names available from DAA	329148mE 7551665mN Zone 50 [Reliable]	
28595	Wheatstone 13	No	No	No Gender Restrictions	Lodged	Artefacts / Scatter	*Registered Knowledge Holder names available from DAA	296491mE 7590771mN Zone 50 [Reliable]	
28596	Wheatstone 14	No	No	No Gender Restrictions	Lodged	Artefacts / Scatter	*Registered Knowledge Holder names available from DAA	296508mE 7590927mN Zone 50 [Reliable]	
28597	Wheatstone 15	No	No	No Gender Restrictions	Stored Data / Not a Site	Artefacts / Scatter	*Registered Knowledge Holder names available from DAA	296684mE 7590913mN Zone 50 [Reliable]	
28604	Wheatstone 18	No	No	No Gender Restrictions	Lodged	Artefacts / Scatter	*Registered Knowledge Holder names available from DAA	297039mE 7589060mN Zone 50 [Reliable]	
28611	Wheatstone 25	No	No	No Gender Restrictions	Lodged	Artefacts / Scatter	*Registered Knowledge Holder names available from DAA	298295mE 7589593mN Zone 50 [Reliable]	
28648	MP08 - 01	No	No	No Gender Restrictions	Stored Data / Not a Site	Artefacts / Scatter, Camp	*Registered Knowledge Holder names available from DAA	341761mE 7558523mN Zone 50 [Reliable]	
28649	MP08 - 02	No	No	No Gender Restrictions	Stored Data / Not a Site	Artefacts / Scatter, Camp	*Registered Knowledge Holder names available from DAA	341055mE 7559048mN Zone 50 [Reliable]	
28650	MP08 - 03	No	No	No Gender Restrictions	Stored Data / Not a Site	Artefacts / Scatter, Grinding Patches / Grooves, Camp	*Registered Knowledge Holder names available from DAA	339306mE 7561020mN Zone 50 [Reliable]	
28651	MP08 - 04	No	No	No Gender Restrictions	Stored Data / Not a Site	Artefacts / Scatter, Historical, Camp	*Registered Knowledge Holder names available from DAA	339173mE 7561236mN Zone 50 [Reliable]	

ID	Name	File Restricted	Boundary Restricted	Restrictions	Status	Type	Knowledge Holders	Coordinate	Legacy ID
28655	MP08 - 09	No	No	No Gender Restrictions	Stored Data / Not a Site	Artefacts / Scatter, Camp	*Registered Knowledge Holder names available from DAA	332559mE 7565923mN Zone 50 [Reliable]	
28656	MP08 - 10	No	No	No Gender Restrictions	Stored Data / Not a Site	Artefacts / Scatter, Historical, Camp	*Registered Knowledge Holder names available from DAA	312168mE 7579120mN Zone 50 [Reliable]	
28657	MP08 - 11	No	No	No Gender Restrictions	Stored Data / Not a Site	Midden / Scatter, Camp, Shell	*Registered Knowledge Holder names available from DAA	278579mE 7592904mN Zone 50 [Reliable]	
28658	MP08 - 15	No	No	No Gender Restrictions	Stored Data / Not a Site	Artefacts / Scatter, Midden / Scatter, Camp, Shell	*Registered Knowledge Holder names available from DAA	288124mE 7592670mN Zone 50 [Reliable]	
28659	MP08 - 16	No	No	No Gender Restrictions	Stored Data / Not a Site	Artefacts / Scatter, Camp	*Registered Knowledge Holder names available from DAA	287817mE 7592254mN Zone 50 [Reliable]	
28661	MP08 - 19	No	No	No Gender Restrictions	Stored Data / Not a Site	Midden / Scatter, Camp, Shell	*Registered Knowledge Holder names available from DAA	282707mE 7592384mN Zone 50 [Reliable]	
28665	MP08 - 23	No	No	No Gender Restrictions	Stored Data / Not a Site	Midden / Scatter, Camp, Shell	*Registered Knowledge Holder names available from DAA	290610mE 7595252mN Zone 50 [Reliable]	
28668	MP08 - 26	No	No	No Gender Restrictions	Stored Data / Not a Site	Artefacts / Scatter, Camp	*Registered Knowledge Holder names available from DAA	289552mE 7594281mN Zone 50 [Reliable]	
28671	MP08 - 29	No	No	No Gender Restrictions	Stored Data / Not a Site	Artefacts / Scatter, Camp, Shell	*Registered Knowledge Holder names available from DAA	294443mE 7592277mN Zone 50 [Reliable]	
28672	MP08 - 30	No	No	No Gender Restrictions	Stored Data / Not a Site	Midden / Scatter, Camp, Shell	*Registered Knowledge Holder names available from DAA	294659mE 7592074mN Zone 50 [Reliable]	
28673	MP08 - 31	No	No	No Gender Restrictions	Stored Data / Not a Site	Artefacts / Scatter, Grinding Patches / Grooves, Camp	*Registered Knowledge Holder names available from DAA	295801mE 7591839mN Zone 50 [Reliable]	
28674	MP08 - 32	No	No	No Gender Restrictions	Stored Data / Not a Site	Artefacts / Scatter, Grinding Patches / Grooves, Camp	*Registered Knowledge Holder names available from DAA	297229mE 7591331mN Zone 50 [Reliable]	

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28675	MP08 - 33	No	No	No Gender Restrictions	Stored Data / Not a Site	Artefacts / Scatter, Grinding Patches / Grooves, Camp	*Registered Knowledge Holder names available from DAA	297159mE 7591330mN Zone 50 [Reliable]	
28680	MP08 - 38	No	No	No Gender Restrictions	Stored Data / Not a Site	Artefacts / Scatter, Grinding Patches / Grooves, Camp	*Registered Knowledge Holder names available from DAA	292309mE 7594090mN Zone 50 [Reliable]	
28681	MP08 - 39	No	No	No Gender Restrictions	Lodged	Artefacts / Scatter, Camp	*Registered Knowledge Holder names available from DAA	292326mE 7593713mN Zone 50 [Reliable]	
28685	MP08 - 43	No	No	No Gender Restrictions	Stored Data / Not a Site	Artefacts / Scatter, Grinding Patches / Grooves, Camp	*Registered Knowledge Holder names available from DAA	295862mE 7591850mN Zone 50 [Reliable]	
28686	MP08 - 45	No	No	No Gender Restrictions	Stored Data / Not a Site	Artefacts / Scatter, Camp	*Registered Knowledge Holder names available from DAA	298418mE 7590810mN Zone 50 [Reliable]	
28687	MP08 - 46	No	No	No Gender Restrictions	Stored Data / Not a Site	Artefacts / Scatter, Grinding Patches / Grooves, Camp	*Registered Knowledge Holder names available from DAA	298719mE 7590939mN Zone 50 [Reliable]	
28688	MP08 - 47	No	No	No Gender Restrictions	Stored Data / Not a Site	Artefacts / Scatter, Grinding Patches / Grooves, Camp	*Registered Knowledge Holder names available from DAA	296689mE 7591528mN Zone 50 [Reliable]	
28689	MP08 - 48	No	No	No Gender Restrictions	Stored Data / Not a Site	Artefacts / Scatter, Grinding Patches / Grooves, Camp	*Registered Knowledge Holder names available from DAA	296805mE 7591387mN Zone 50 [Reliable]	
28690	MP 08 Isolated Finds	No	No	No Gender Restrictions	Lodged	Other: 41 Isolated artefacts	*Registered Knowledge Holder names available from DAA	290810mE 7595464mN Zone 50 [Reliable]	
28696	MP08 - 12	No	No	No Gender Restrictions	Stored Data / Not a Site	Midden / Scatter, Camp, Shell	*Registered Knowledge Holder names available from DAA	278880mE 7592827mN Zone 50 [Reliable]	
28697	MP08 - 13	No	No	No Gender Restrictions	Stored Data / Not a Site	Midden / Scatter, Arch Deposit, Other: One manuport	*Registered Knowledge Holder names available from DAA	279024mE 7592847mN Zone 50 [Reliable]	
28698	MP08 - 14	No	No	No Gender Restrictions	Stored Data / Not a Site	Midden / Scatter, Camp, Shell	*Registered Knowledge Holder names available from DAA	279096mE 7592812mN Zone 50 [Reliable]	

ID	Name	File Restricted	Boundary Restricted	Restrictions	Status	Type	Knowledge Holders	Coordinate	Legacy ID
28699	MP08 - 49	No	No	No Gender Restrictions	Stored Data / Not a Site	Artefacts / Scatter, Grinding Patches / Grooves, Camp	*Registered Knowledge Holder names available from DAA	295712mE 7591683mN Zone 50 [Reliable]	
28715	Wheatstone 3	No	No	No Gender Restrictions	Stored Data / Not a Site	Midden / Scatter, Shell	*Registered Knowledge Holder names available from DAA	292579mE 7600776mN Zone 50 [Reliable]	
28717	Wheatstone 5	No	No	No Gender Restrictions	Lodged	Artefacts / Scatter, Midden / Scatter, Shell	*Registered Knowledge Holder names available from DAA	291079mE 7599369mN Zone 50 [Reliable]	
28718	Wheatstone 6	No	No	No Gender Restrictions	Lodged	Midden / Scatter, Shell	*Registered Knowledge Holder names available from DAA	291258mE 7599345mN Zone 50 [Reliable]	
28719	Wheatstone 7	No	No	No Gender Restrictions	Lodged	Artefacts / Scatter, Midden / Scatter, Shell	*Registered Knowledge Holder names available from DAA	290879mE 7599315mN Zone 50 [Reliable]	
28720	Wheatstone 8	No	No	No Gender Restrictions	Lodged	Midden / Scatter, Shell	*Registered Knowledge Holder names available from DAA	290916mE 7599166mN Zone 50 [Reliable]	
28721	Wheatstone 9	No	No	No Gender Restrictions	Lodged	Artefacts / Scatter	*Registered Knowledge Holder names available from DAA	296279mE 7590192mN Zone 50 [Reliable]	
28722	Wheatstone 10	No	No	No Gender Restrictions	Stored Data / Not a Site	Artefacts / Scatter	*Registered Knowledge Holder names available from DAA	294477mE 7597078mN Zone 50 [Reliable]	
28723	Wheatstone 11	No	No	No Gender Restrictions	Lodged	Artefacts / Scatter	*Registered Knowledge Holder names available from DAA	296348mE 7590595mN Zone 50 [Reliable]	
29150	Loop 1 Isolated Artefacts	No	No	No Gender Restrictions	Stored Data / Not a Site	Other: Two isolated artefacts	*Registered Knowledge Holder names available from DAA	338242mE 7547682mN Zone 50 [Reliable]	
29549	Boodie Soak	No	No	No Gender Restrictions	Lodged	Artefacts / Scatter	*Registered Knowledge Holder names available from DAA	333058mE 7702494mN Zone 50 [Reliable]	
29998	Wheatstone 28	Yes	Yes	No Gender Restrictions	Stored Data / Not a Site	Artefacts / Scatter, Grinding Patches / Grooves	*Registered Knowledge Holder names available from DAA	Not available when location is restricted	

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29999	Wheatstone 29	Yes	Yes	No Gender Restrictions	Stored Data / Not a Site	Artefacts / Scatter, Grinding Patches / Grooves	*Registered Knowledge Holder names available from DAA	Not available when location is restricted	
30006	Wheatstone Isolated Artefacts	No	No	No Gender Restrictions	Lodged	Other: 324 Isolated Artefacts	*Registered Knowledge Holder names available from DAA	293006mE 7592791mN Zone 50 [Reliable]	
30588	Limestone Quarry	No	No	No Gender Restrictions	Lodged	Artefacts / Scatter, Grinding Patches / Grooves, Midden / Scatter	*Registered Knowledge Holder names available from DAA	286218mE 7593631mN Zone 50 [Reliable]	
31762	Site 1	No	No	No Gender Restrictions	Lodged	Artefacts / Scatter	*Registered Knowledge Holder names available from DAA	332664mE 7694168mN Zone 50 [Reliable]	
31763	Site 2	No	No	No Gender Restrictions	Lodged	Artefacts / Scatter	*Registered Knowledge Holder names available from DAA	332528mE 7694213mN Zone 50 [Reliable]	
31854	WW Isolated Finds	No	No	No Gender Restrictions	Lodged	Other: 247 Isolated Artefacts	*Registered Knowledge Holder names available from DAA	322101mE 7566834mN Zone 50 [Reliable]	
31862	WW-Q-4309	No	No	No Gender Restrictions	Lodged	Quarry	*Registered Knowledge Holder names available from DAA	322353mE 7563885mN Zone 50 [Reliable]	
32295	MP 11-04	No	No	No Gender Restrictions	Stored Data / Not a Site	Artefacts / Scatter	*Registered Knowledge Holder names available from DAA	296069mE 7591661mN Zone 50 [Reliable]	
32402	Onslow Airport 01	No	No	No Gender Restrictions	Stored Data / Not a Site	Midden / Scatter, Camp	*Registered Knowledge Holder names available from DAA	304137mE 7602378mN Zone 50 [Reliable]	
32539	LCOR-1209	No	No	No Gender Restrictions	Stored Data / Not a Site	Artefacts / Scatter	*Registered Knowledge Holder names available from DAA	299925mE 7591618mN Zone 50 [Reliable]	
32540	LCOR-1201	No	No	No Gender Restrictions	Stored Data / Not a Site	Artefacts / Scatter, Midden / Scatter	*Registered Knowledge Holder names available from DAA	304545mE 7605239mN Zone 50 [Reliable]	
32541	LCOR-1202	No	No	No Gender Restrictions	Stored Data / Not a Site	Artefacts / Scatter, Midden / Scatter	*Registered Knowledge Holder names available from DAA	304464mE 7605167mN Zone 50 [Reliable]	

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ID	Name	File Restricted	Boundary Restricted	Restrictions	Status	Type	Knowledge Holders	Coordinate	Legacy ID
32542	LCOR-1203	No	No	No Gender Restrictions	Stored Data / Not a Site	Artefacts / Scatter, Midden / Scatter	*Registered Knowledge Holder names available from DAA	304459mE 7605142mN Zone 50 [Reliable]	
32543	LCOR-1204	No	No	No Gender Restrictions	Stored Data / Not a Site	Artefacts / Scatter, Midden / Scatter	*Registered Knowledge Holder names available from DAA	304420mE 7605124mN Zone 50 [Reliable]	
32544	LCOR-1205	No	No		Stored Data / Not a Site	Artefacts / Scatter, Midden / Scatter	*Registered Knowledge Holder names available from DAA	304407mE 7605039mN Zone 50 [Reliable]	
32545	LCOR-1206	No	No	No Gender Restrictions	Stored Data / Not a Site	Artefacts / Scatter, Midden / Scatter	*Registered Knowledge Holder names available from DAA	304392mE 7605188mN Zone 50 [Reliable]	
32546	LCOR-1207	No	No	No Gender Restrictions	Stored Data / Not a Site	Artefacts / Scatter, Midden / Scatter	*Registered Knowledge Holder names available from DAA	304367mE 7605154mN Zone 50 [Reliable]	
32547	LCOR-1208	No	No	No Gender Restrictions	Stored Data / Not a Site	Artefacts / Scatter, Midden / Scatter	*Registered Knowledge Holder names available from DAA	304354mE 7605178mN Zone 50 [Reliable]	
33069	Wheatstone 61	No	No	No Gender Restrictions	Stored Data / Not a Site	Artefacts / Scatter	*Registered Knowledge Holder names available from DAA	289680mE 7596300mN Zone 50 [Reliable]	
33071	TS02 / AH091	No	No	No Gender Restrictions	Stored Data / Not a Site	Artefacts / Scatter	*Registered Knowledge Holder names available from DAA	295186mE 7588332mN Zone 50 [Reliable]	
33072	HSI3 / AH054	No	No	No Gender Restrictions	Stored Data / Not a Site	Artefacts / Scatter	*Registered Knowledge Holder names available from DAA	297602mE 7595893mN Zone 50 [Reliable]	
33073	HSI1 / AH052	No	No	No Gender Restrictions	Stored Data / Not a Site	Artefacts / Scatter	*Registered Knowledge Holder names available from DAA	297098mE 7595722mN Zone 50 [Reliable]	
33074	HSI2 / AH053	No	No	No Gender Restrictions	Stored Data / Not a Site	Artefacts / Scatter	*Registered Knowledge Holder names available from DAA	298145mE 7596039mN Zone 50 [Reliable]	
33075	B12-02	No	No	No Gender Restrictions	Stored Data / Not a Site	Artefacts / Scatter	*Registered Knowledge Holder names available from DAA	297226mE 7592038mN Zone 50 [Reliable]	

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ID	Name	File Restricted	Boundary Restricted	Restrictions	Status	Type	Knowledge Holders	Coordinate	Legacy ID
33078	WH12-03	No	No	No Gender Restrictions	Stored Data / Not a Site	Artefacts / Scatter	*Registered Knowledge Holder names available from DAA	297571mE 7591259mN Zone 50 [Reliable]	
33394	WH12-19	No	No	No Gender Restrictions	Stored Data / Not a Site	Artefacts / Scatter	*Registered Knowledge Holder names available from DAA	312239mE 7579271mN Zone 50 [Reliable]	
33395	WH12-18	No	No	No Gender Restrictions	Stored Data / Not a Site	Artefacts / Scatter	*Registered Knowledge Holder names available from DAA	312168mE 7578971mN Zone 50 [Reliable]	
33396	WH12-16	No	No	No Gender Restrictions	Stored Data / Not a Site	Artefacts / Scatter	*Registered Knowledge Holder names available from DAA	309520mE 7580923mN Zone 50 [Reliable]	
33397	WH12-15	No	No	No Gender Restrictions	Stored Data / Not a Site	Artefacts / Scatter	*Registered Knowledge Holder names available from DAA	309713mE 7580839mN Zone 50 [Reliable]	
33398	WH12-14	No	No	No Gender Restrictions	Stored Data / Not a Site	Artefacts / Scatter	*Registered Knowledge Holder names available from DAA	326966mE 7570293mN Zone 50 [Reliable]	
33399	WH12-13	No	No	No Gender Restrictions	Stored Data / Not a Site	Artefacts / Scatter	*Registered Knowledge Holder names available from DAA	329106mE 7568529mN Zone 50 [Reliable]	
33400	WH12-12	No	No	No Gender Restrictions	Stored Data / Not a Site	Artefacts / Scatter	*Registered Knowledge Holder names available from DAA	331196mE 7566919mN Zone 50 [Reliable]	
33401	WH12-11	No	No	No Gender Restrictions	Stored Data / Not a Site	Artefacts / Scatter	*Registered Knowledge Holder names available from DAA	331267mE 7566837mN Zone 50 [Reliable]	
33402	WH12-10	No	No	No Gender Restrictions	Stored Data / Not a Site	Artefacts / Scatter	*Registered Knowledge Holder names available from DAA	337695mE 7562313mN Zone 50 [Reliable]	
33403	WH12-09	No	No	No Gender Restrictions	Stored Data / Not a Site	Artefacts / Scatter	*Registered Knowledge Holder names available from DAA	338133mE 7561953mN Zone 50 [Reliable]	
33404	WH12-08	No	No	No Gender Restrictions	Stored Data / Not a Site	Artefacts / Scatter	*Registered Knowledge Holder names available from DAA	341108mE 7558920mN Zone 50 [Reliable]	

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ID	Name	File Restricted	Boundary Restricted	Restrictions	Status	Type	Knowledge Holders	Coordinate	Legacy ID
33405	WH12-07	No	No	No Gender Restrictions	Stored Data / Not a Site	Artefacts / Scatter	*Registered Knowledge Holder names available from DAA	342904mE 7557720mN Zone 50 [Reliable]	
33406	THAL-14	No	No	No Gender Restrictions	Stored Data / Not a Site	Artefacts / Scatter	*Registered Knowledge Holder names available from DAA	339708mE 7560683mN Zone 50 [Reliable]	
34025	TGP-L-1 (Tubridgi Gas Pipeline Lateral 1)	No	No	No Gender Restrictions	Stored Data / Not a Site	Artefacts / Scatter	*Registered Knowledge Holder names available from DAA	292032mE 7592553mN Zone 50 [Reliable]	
34026	TGP-V-1 (Tubridgi Gas Pipeline Vertical 1)	No	No	No Gender Restrictions	Stored Data / Not a Site	Artefacts / Scatter	*Registered Knowledge Holder names available from DAA	284672mE 7583111mN Zone 50 [Reliable]	
34027	TGP-V-2 (Tubridgi Gas Pipeline Vertical 2)	No	No	No Gender Restrictions	Stored Data / Not a Site	Artefacts / Scatter	*Registered Knowledge Holder names available from DAA	293447mE 7564015mN Zone 50 [Reliable]	
34028	TGP-V--3 (Tubridgi Gas Pipeline Vertical3)	No	No	No Gender Restrictions	Stored Data / Not a Site	Artefacts / Scatter	*Registered Knowledge Holder names available from DAA	300360mE 7550265mN Zone 50 [Reliable]	
34029	TGP-V-4 (Tubridgi Gas Pipeline Vertical 4)	No	No	No Gender Restrictions	Stored Data / Not a Site	Artefacts / Scatter	*Registered Knowledge Holder names available from DAA	302139mE 7547316mN Zone 50 [Reliable]	
34030	TGP-V-5 (Tubridgi Gas Pipeline Vertical 5)	No	No	No Gender Restrictions	Stored Data / Not a Site	Artefacts / Scatter	*Registered Knowledge Holder names available from DAA	307398mE 7536832mN Zone 50 [Reliable]	
34031	TGP-V-6 (Tubridgi Gas Pipeline Vertical 6)	No	No	No Gender Restrictions	Stored Data / Not a Site	Artefacts / Scatter	*Registered Knowledge Holder names available from DAA	308115mE 7535097mN Zone 50 [Reliable]	
34032	TGP-V-7 (Tubridgi Gas Pipeline Vertical 7)	No	No	No Gender Restrictions	Stored Data / Not a Site	Artefacts / Scatter	*Registered Knowledge Holder names available from DAA	308132mE 7535030mN Zone 50 [Reliable]	
34033	TGP-V-8 (Tubridgi Gas Pipeline Vertical 8)	No	No	No Gender Restrictions	Stored Data / Not a Site	Artefacts / Scatter	*Registered Knowledge Holder names available from DAA	310415mE 7529724mN Zone 50 [Reliable]	
34034	TGP-V-9 (Tubridgi Gas Pipeline Vertical 9)	No	No	No Gender Restrictions	Stored Data / Not a Site	Artefacts / Scatter	*Registered Knowledge Holder names available from DAA	310474mE 7529589mN Zone 50 [Reliable]	

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ID	Name	File Restricted	Boundary Restricted	Restrictions	Status	Type	Knowledge Holders	Coordinate	Legacy ID
34035	TGP-V-10 (Tubridgi Gas Pipeline Vertical 10)	No	No	No Gender Restrictions	Stored Data / Not a Site	Artefacts / Scatter	*Registered Knowledge Holder names available from DAA	311408mE 7527825mN Zone 50 [Reliable]	
34036	TGP-V-11 (Tubridgi Gas Pipeline Vertical 11)	No	No	No Gender Restrictions	Stored Data / Not a Site	Artefacts / Scatter	*Registered Knowledge Holder names available from DAA	315878mE 7518664mN Zone 50 [Reliable]	
34037	TGP-V-12 (Tubridgi Gas Pipeline Vertical 12)	No	No	No Gender Restrictions	Stored Data / Not a Site	Artefacts / Scatter	*Registered Knowledge Holder names available from DAA	315749mE 7517550mN Zone 50 [Reliable]	
34038	TGP-V-13 (Tubridgi Gas Pipeline Vertical 13)	No	No	No Gender Restrictions	Stored Data / Not a Site	Artefacts / Scatter	*Registered Knowledge Holder names available from DAA	315671mE 7517125mN Zone 50 [Reliable]	
34039	TGP-V-14 (Tubridgi Gas Pipeline Vertical 14)	No	No	No Gender Restrictions	Stored Data / Not a Site	Artefacts / Scatter	*Registered Knowledge Holder names available from DAA	317977mE 7514480mN Zone 50 [Reliable]	
34446	MRO14-01	No	No		Stored Data / Not a Site	Artefacts / Scatter, Midden / Scatter, Arch Deposit, Birth Place, Camp, Hunting Place, Meeting Place, Named Place, Natural Feature, Plant Resource, Water Source	*Registered Knowledge Holder names available from DAA	304379mE 7605103mN Zone 50 [Reliable]	
35435	MRO14-02	No	No		Stored Data / Not a Site	Midden / Scatter	*Registered Knowledge Holder names available from DAA	304122mE 7605663mN Zone 50 [Unreliable]	
36199	Boodie Cave	No	No		Lodged	Artefacts / Scatter, Rockshelter	*Registered Knowledge Holder names available from DAA	329709mE 7703887mN Zone 50 [Reliable]	
36234	South End structures, Barrow Island.	No	No		Lodged	Historical, Man-Made Structure	*Registered Knowledge Holder names available from DAA	326057mE 7689365mN Zone 50 [Unreliable]	
36261	G-13-S0001	No	No		Lodged	Quarry	*Registered Knowledge Holder names available from DAA	329032mE 7702259mN Zone 50 [Reliable]	
36262	H-24-S0001	No	No		Lodged	Artefacts / Scatter	*Registered Knowledge Holder names available from DAA	330962mE 7691480mN Zone 50 [Reliable]	

ID	Name	File Restricted	Boundary Restricted	Restrictions	Status	Type	Knowledge Holders	Coordinate	Legacy ID
36263	H-24-S0002	No	No		Lodged	Artefacts / Scatter	*Registered Knowledge Holder names available from DAA	330959mE 7691251mN Zone 50 [Reliable]	
36264	I-23-S0001	No	No		Lodged	Artefacts / Scatter	*Registered Knowledge Holder names available from DAA	331260mE 7692010mN Zone 50 [Reliable]	
36265	I-23-S0002	No	No		Lodged	Artefacts / Scatter	*Registered Knowledge Holder names available from DAA	331643mE 7692090mN Zone 50 [Reliable]	
36266	I-24-S0003	No	No		Lodged	Artefacts / Scatter	*Registered Knowledge Holder names available from DAA	331552mE 7691950mN Zone 50 [Reliable]	
36267	J-23-S0001	No	No		Lodged	Grinding Patches / Grooves	*Registered Knowledge Holder names available from DAA	332215mE 7692570mN Zone 50 [Reliable]	
36268	J-23-S0002	No	No		Lodged	Artefacts / Scatter	*Registered Knowledge Holder names available from DAA	332208mE 7692431mN Zone 50 [Reliable]	
36269	J-23-S0003	No	No		Lodged	Modified Tree	*Registered Knowledge Holder names available from DAA	332193mE 7692286mN Zone 50 [Reliable]	
36270	M-03-S0001	No	No		Lodged	Artefacts / Scatter	*Registered Knowledge Holder names available from DAA	335996mE 7712066mN Zone 50 [Reliable]	
36271	N-02-S0001	No	No		Lodged	Artefacts / Scatter	*Registered Knowledge Holder names available from DAA	336855mE 7713004mN Zone 50 [Reliable]	
36272	O-02-S0002	No	No		Lodged	Artefacts / Scatter	*Registered Knowledge Holder names available from DAA	337100mE 7713272mN Zone 50 [Reliable]	
36273	O-05-S0003	No	No		Lodged	Artefacts / Scatter	*Registered Knowledge Holder names available from DAA	337727mE 7710822mN Zone 50 [Reliable]	
36348	P-04-S0001	No	No		Lodged	Artefacts / Scatter	*Registered Knowledge Holder names available from DAA	338193mE 7711023mN Zone 50 [Reliable]	

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ID	Name	File Restricted	Boundary Restricted	Restrictions	Status	Type	Knowledge Holders	Coordinate	Legacy ID
37460	Warralee East Artefact Scatter	No	No		Stored Data / Not a Site	Artefacts / Scatter	*Registered Knowledge Holder names available from DAA	303354mE 7552719mN Zone 50 [Reliable]	
37465	Warralee East Scarred Tree	No	No		Stored Data / Not a Site	Modified Tree	*Registered Knowledge Holder names available from DAA	302174mE 7552896mN Zone 50 [Reliable]	
37469	Tattarang Artefact Scatter	No	No		Stored Data / Not a Site	Artefacts / Scatter	*Registered Knowledge Holder names available from DAA	315930mE 7532428mN Zone 50 [Reliable]	
38694	Mandu Mandu Creek South Rockshelter 5 (MMCSR5)	No	No		Lodged	Artefacts / Scatter, Grinding Patches / Grooves, Rockshelter	*Registered Knowledge Holder names available from DAA	797118mE 7545777mN Zone 49 [Reliable]	
38695	Mandu Mandu Creek South Rockshelter 8 (MMCSR8)	No	No		Lodged	Artefacts / Scatter, Rockshelter	*Registered Knowledge Holder names available from DAA	796803mE 7546076mN Zone 49 [Reliable]	

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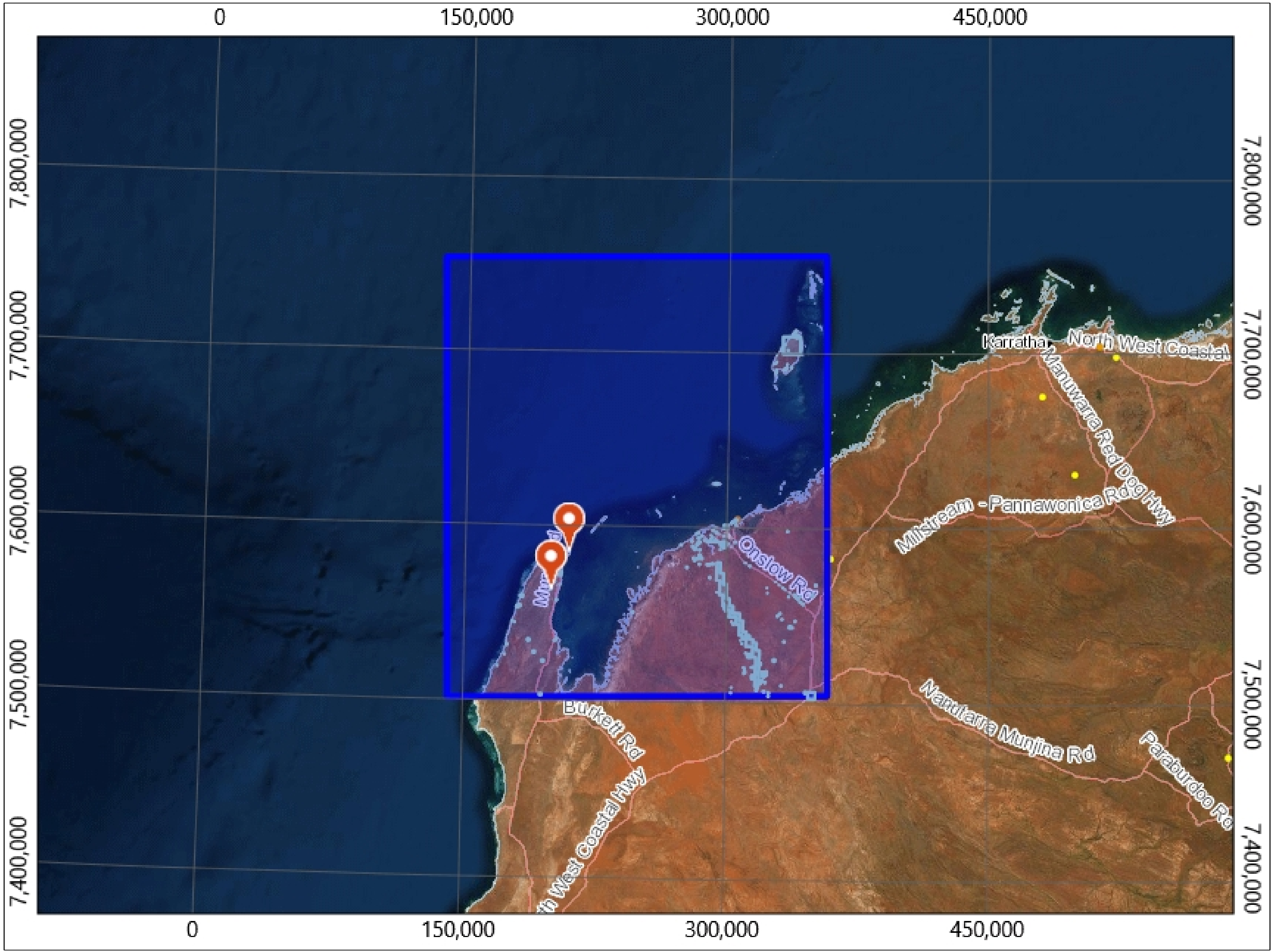

Legend

▢ Other Heritage Place
🟦 Search Area
● Town
— Road
— River
🟩 Local Government Authority

117.91 kilometres

Map Scale 1 : 3,570,000

MGA Zone 50 (GDA94)

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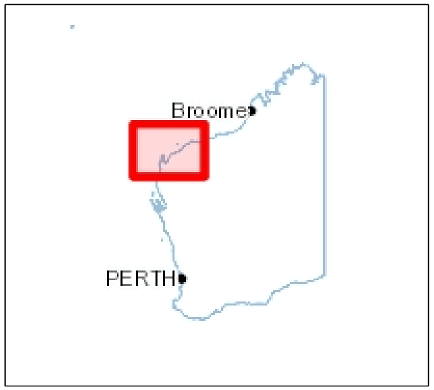

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Search Criteria

235 Registered Aboriginal Sites in Custom search area - Polygon - 113.506511182827°E, 22.5493218645815°S (GDA94) : 113.506511182827°E, 20.2840757397128°S (GDA94) : 115.610393018765°E, 20.2840757397128°S (GDA94) : 115.610393018765°E, 22.5493218645815°S (GDA94) : 113.506511182827°E, 22.5493218645815°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.

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Coordinate Accuracy

Coordinates (Easting/Northing metres) are based on the GDA 94 Datum. Accuracy is shown as a code in brackets following the coordinates.

Terminology (NB that some terminology has varied over the life of the legislation)

Place ID/Site ID: This a unique ID assigned by the Department of Planning, Lands and Heritage to the place.
Status:

- Registered Site: The place has been assessed as meeting Section 5 of the Aboriginal Heritage Act 1972.
- Other Heritage Place which includes:
  - Stored Data / Not a Site: The place has been assessed as not meeting Section 5 of the Aboriginal Heritage Act 1972.
  - Lodged: Information has been received in relation to the place, but an assessment has not been completed at this stage to determine if it meets Section 5 of the Aboriginal Heritage Act 1972.

Access and Restrictions:

- File Restricted = No: Availability of information that the Department of Planning, Lands and Heritage holds in relation to the place is not restricted in any way.
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- Boundary Restricted = No: Place location is shown as accurately as the information lodged with the Registrar allows.
- Boundary Restricted = Yes: To preserve confidentiality the exact location and extent of the place is not displayed on the map. However, the shaded region (generally with an area of at least 4km²) provides a general indication of where the place is located. If you are a landowner and wish to find out more about the exact location of the place, please contact the Department of Planning, Lands and Heritage.
- Restrictions:
  - No Restrictions: Anyone can view the information.
  - Male Access Only: Only males can view restricted information.
  - Female Access Only: Only females can view restricted information.

Legacy ID: This is the former unique number that the former Department of Aboriginal Sites assigned to the place. This has been replaced by the Place ID / Site ID.

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ID	Name	File Restricted	Boundary Restricted	Restrictions	Status	Type	Knowledge Holders	Coordinate	Legacy ID
508	POINT MURAT 03	No	No	No Gender Restrictions	Registered Site	Artefacts / Scatter, Midden / Scatter	*Registered Knowledge Holder names available from DAA	209042mE 7584688mN Zone 50 [Reliable]	P07503
509	POINT MURAT 04	No	No	No Gender Restrictions	Registered Site	Artefacts / Scatter	*Registered Knowledge Holder names available from DAA	208690mE 7584604mN Zone 50 [Reliable]	P07504
561	MOWBOWRA CREEK 01	No	No	No Gender Restrictions	Registered Site	Artefacts / Scatter	*Registered Knowledge Holder names available from DAA	198764mE 7564207mN Zone 50 [Reliable]	P07499
562	MOWBOWRA CREEK 02	No	No	No Gender Restrictions	Registered Site	Artefacts / Scatter	*Registered Knowledge Holder names available from DAA	199217mE 7564242mN Zone 50 [Reliable]	P07500
563	POINT MURAT 01	No	No	No Gender Restrictions	Registered Site	Artefacts / Scatter, Midden / Scatter	*Registered Knowledge Holder names available from DAA	208716mE 7585665mN Zone 50 [Reliable]	P07501
564	POINT MURAT 02	No	No	No Gender Restrictions	Registered Site	Artefacts / Scatter, Midden / Scatter	*Registered Knowledge Holder names available from DAA	209079mE 7585539mN Zone 50 [Reliable]	P07502
628	CAMP THIRTEEN BURIAL	No	No	No Gender Restrictions	Registered Site	Skeletal Material / Burial	*Registered Knowledge Holder names available from DAA	800392mE 7559449mN Zone 49 [Reliable]	P07434
756	WINPIKANYA	Yes	Yes	Female Access Only	Registered Site	Ceremonial, Engraving, Grinding Patches / Grooves, Mythological, Camp, Water Source	*Registered Knowledge Holder names available from DAA	Not available when location is restricted	P07360
808	SAPPHIRE 1	No	No	No Gender Restrictions	Registered Site	Artefacts / Scatter, Camp, Other: 1920'S-1940'S	*Registered Knowledge Holder names available from DAA	278238mE 7586855mN Zone 50 [Reliable]	P07319
811	URALA 94 B	No	No	No Gender Restrictions	Registered Site	Midden / Scatter	*Registered Knowledge Holder names available from DAA	273738mE 7591155mN Zone 50 [Unreliable]	P07322
812	URALA 94 C	No	No	No Gender Restrictions	Registered Site	Midden / Scatter	*Registered Knowledge Holder names available from DAA	279638mE 7592855mN Zone 50 [Reliable]	P07323
813	URALA 94 D	No	No	No Gender Restrictions	Registered Site	Artefacts / Scatter	*Registered Knowledge Holder names available from DAA	278938mE 7587655mN Zone 50 [Unreliable]	P07324

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ID	Name	File Restricted	Boundary Restricted	Restrictions	Status	Type	Knowledge Holders	Coordinate	Legacy ID
814	URALA 94 E	No	No	No Gender Restrictions	Registered Site	Artefacts / Scatter	*Registered Knowledge Holder names available from DAA	276538mE 7585755mN Zone 50 [Unreliable]	P07325
873	MONTEBELLO IS: NOALA CAVE.	No	No	No Gender Restrictions	Registered Site	Artefacts / Scatter, Midden / Scatter, Rockshelter, BP Dating: 27,220 +/- 640	*Registered Knowledge Holder names available from DAA	348188mE 7741053mN Zone 50 [Reliable]	P07287
926	MONTEBELLO IS: HAYNES CAVE.	No	No	No Gender Restrictions	Registered Site	Artefacts / Scatter, Midden / Scatter, Rockshelter, Arch Deposit	*Registered Knowledge Holder names available from DAA	348289mE 7741005mN Zone 50 [Reliable]	P07286
5920	GRIFFIN GAS 23	No	No	No Gender Restrictions	Registered Site	Midden / Scatter	*Registered Knowledge Holder names available from DAA	299739mE 7592755mN Zone 50 [Reliable]	P07181
5949	AMBER 1	No	No	No Gender Restrictions	Registered Site	Artefacts / Scatter	*Registered Knowledge Holder names available from DAA	306339mE 7590555mN Zone 50 [Reliable]	P07156
5951	Griffin Gas 01	No	No	No Gender Restrictions	Registered Site	Midden / Scatter	*Registered Knowledge Holder names available from DAA	277914mE 7593101mN Zone 50 [Reliable]	P07159
5952	GRIFFIN GAS 02	No	No	No Gender Restrictions	Registered Site	Midden / Scatter	*Registered Knowledge Holder names available from DAA	277836mE 7593278mN Zone 50 [Reliable]	P07160
5953	GRIFFIN GAS 03	No	No	No Gender Restrictions	Registered Site	Midden / Scatter, Skeletal Material / Burial	*Registered Knowledge Holder names available from DAA	277733mE 7593174mN Zone 50 [Reliable]	P07161
5954	GRIFFIN GAS 04	No	No	No Gender Restrictions	Registered Site	Midden / Scatter	*Registered Knowledge Holder names available from DAA	277685mE 7593254mN Zone 50 [Reliable]	P07162
5955	GRIFFIN GAS 05	No	No	No Gender Restrictions	Registered Site	Midden / Scatter	*Registered Knowledge Holder names available from DAA	277781mE 7593367mN Zone 50 [Reliable]	P07163
5966	GRIFFIN GAS 16	No	No	No Gender Restrictions	Registered Site	Artefacts / Scatter	*Registered Knowledge Holder names available from DAA	292697mE 7592756mN Zone 50 [Reliable]	P07174
5968	GRIFFIN GAS 18	No	No	No Gender Restrictions	Registered Site	Artefacts / Scatter, Midden / Scatter	*Registered Knowledge Holder names available from DAA	294739mE 7592755mN Zone 50 [Reliable]	P07176

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ID	Name	File Restricted	Boundary Restricted	Restrictions	Status	Type	Knowledge Holders	Coordinate	Legacy ID
5969	GRIFFIN GAS 19	No	No	No Gender Restrictions	Registered Site	Midden / Scatter	*Registered Knowledge Holder names available from DAA	295339mE 7592755mN Zone 50 [Reliable]	P07177
5970	GRIFFIN GAS 20	No	No	No Gender Restrictions	Registered Site	Midden / Scatter	*Registered Knowledge Holder names available from DAA	295539mE 7592755mN Zone 50 [Reliable]	P07178
5971	GRIFFIN GAS 21	No	No	No Gender Restrictions	Registered Site	Artefacts / Scatter, Midden / Scatter	*Registered Knowledge Holder names available from DAA	296039mE 7592755mN Zone 50 [Reliable]	P07179
5972	GRIFFIN GAS 22	No	No	No Gender Restrictions	Registered Site	Artefacts / Scatter, Midden / Scatter	*Registered Knowledge Holder names available from DAA	299539mE 7592755mN Zone 50 [Reliable]	P07180
6017	YARDIE CREEK CARAVAN BURIAL	No	No	No Gender Restrictions	Registered Site	Skeletal Material / Burial	*Registered Knowledge Holder names available from DAA	191538mE 7576555mN Zone 50 [Unreliable]	P07115
6117	MOWBOWRA POOL.	No	No	No Gender Restrictions	Registered Site	Grinding Patches / Grooves, Camp, Other: ?	*Registered Knowledge Holder names available from DAA	202138mE 7564155mN Zone 50 [Reliable]	P07006
6118	QUALING POOL.	No	No	No Gender Restrictions	Registered Site	Camp, Other: ?	*Registered Knowledge Holder names available from DAA	202138mE 7562155mN Zone 50 [Reliable]	P07007
6175	NANUTARRA ROADHOUSE	No	No	No Gender Restrictions	Registered Site	Artefacts / Scatter	*Registered Knowledge Holder names available from DAA	345937mE 7505759mN Zone 50 [Reliable]	P06960
6176	PARRY RANGE	No	No	No Gender Restrictions	Registered Site	Artefacts / Scatter	*Registered Knowledge Holder names available from DAA	348239mE 7531355mN Zone 50 [Reliable]	P06961
6311	POINT MURAT.	No	No	No Gender Restrictions	Registered Site	Artefacts / Scatter, Midden / Scatter, Skeletal Material / Burial, Camp, Other: ?	*Registered Knowledge Holder names available from DAA	208538mE 7584405mN Zone 50 [Reliable]	P06628
6526	RED DUNE SCATTER 2	No	No	No Gender Restrictions	Registered Site	Artefacts / Scatter	*Registered Knowledge Holder names available from DAA	297339mE 7557055mN Zone 50 [Reliable]	P06423
6529	WARRALEE WELL EAST 1.	No	No	No Gender Restrictions	Registered Site	Artefacts / Scatter, Arch Deposit, Camp, Shell, Other: ?	*Registered Knowledge Holder names available from DAA	299139mE 7554155mN Zone 50 [Reliable]	P06426

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6530	WARRALEE WELL EAST 2	No	No	No Gender Restrictions	Registered Site	Artefacts / Scatter	*Registered Knowledge Holder names available from DAA	298139mE 7553855mN Zone 50 [Reliable]	P06427
6532	JAMINU WELL SOUTH	No	No	No Gender Restrictions	Registered Site	Artefacts / Scatter	*Registered Knowledge Holder names available from DAA	309887mE 7535616mN Zone 50 [Unreliable]	P06429
6533	MANYINGEE HILL SOUTH.	No	No	No Gender Restrictions	Registered Site	Quarry, Arch Deposit, Other: ?	*Registered Knowledge Holder names available from DAA	317039mE 7516055mN Zone 50 [Reliable]	P06430
6534	URALA DUNE.	No	No	No Gender Restrictions	Registered Site	Artefacts / Scatter, Arch Deposit, Shell	*Registered Knowledge Holder names available from DAA	275938mE 7591055mN Zone 50 [Reliable]	P06431
6535	URALA STATION SOUTH	No	No	No Gender Restrictions	Registered Site	Midden / Scatter	*Registered Knowledge Holder names available from DAA	274838mE 7591155mN Zone 50 [Reliable]	P06432
6536	URALA DUNE RIDGE	No	No	No Gender Restrictions	Registered Site	Artefacts / Scatter, Midden / Scatter	*Registered Knowledge Holder names available from DAA	278038mE 7589655mN Zone 50 [Reliable]	P06433
6537	URALA SAND RIDGE	No	No	No Gender Restrictions	Registered Site	Artefacts / Scatter, Midden / Scatter	*Registered Knowledge Holder names available from DAA	279988mE 7590655mN Zone 50 [Reliable]	P06434
6538	QUEEBULLA CLAYPAN.	No	No	No Gender Restrictions	Registered Site	Camp	*Registered Knowledge Holder names available from DAA	294224mE 7555049mN Zone 50 [Reliable]	P06435
6541	URALA STATION WEST	Yes	Yes	No Gender Restrictions	Registered Site	Ceremonial	*Registered Knowledge Holder names available from DAA	Not available when location is restricted	P06438
6542	URALA BURIAL	No	No	No Gender Restrictions	Registered Site	Skeletal Material / Burial	*Registered Knowledge Holder names available from DAA	274138mE 7590155mN Zone 50 [Unreliable]	P06439
6572	OLD RACECOURSE CAMP.	Yes	Yes	No Gender Restrictions	Registered Site	Camp	*Registered Knowledge Holder names available from DAA	Not available when location is restricted	P06367
6573	OLD RACECOURSE CEREMONIAL.	Yes	Yes	No Gender Restrictions	Registered Site	Ceremonial, Camp, Meeting Place	*Registered Knowledge Holder names available from DAA	Not available when location is restricted	P06368

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6574	BEADON CREEK MIDDEN.	Yes	Yes	No Gender Restrictions	Registered Site	Artefacts / Scatter, Midden / Scatter, Arch Deposit, Other: ?	*Registered Knowledge Holder names available from DAA	Not available when location is restricted	P06369
6575	JINTA 1 MIDDEN	Yes	Yes	No Gender Restrictions	Registered Site	Artefacts / Scatter, Midden / Scatter	*Registered Knowledge Holder names available from DAA	Not available when location is restricted	P06370
6617	BURUBARLADJI	Yes	Yes	No Gender Restrictions	Registered Site	Mythological	*Registered Knowledge Holder names available from DAA	Not available when location is restricted	P06362
6618	DEW TALU.	Yes	Yes	No Gender Restrictions	Registered Site	Ceremonial, Water Source	*Registered Knowledge Holder names available from DAA	Not available when location is restricted	P06363
6619	JINTA 1.	Yes	Yes	No Gender Restrictions	Registered Site	Water Source	*Registered Knowledge Holder names available from DAA	Not available when location is restricted	P06364
6620	JINTA 2.	Yes	Yes	No Gender Restrictions	Registered Site	Water Source	*Registered Knowledge Holder names available from DAA	Not available when location is restricted	P06365
6754	OSPREY BAY 6	No	No	No Gender Restrictions	Registered Site	Artefacts / Scatter, Midden / Scatter	*Registered Knowledge Holder names available from DAA	792942mE 7538749mN Zone 49 [Reliable]	P06165
6755	OSPREY BAY INTERDUNAL 1	No	No	No Gender Restrictions	Registered Site	Artefacts / Scatter, Midden / Scatter	*Registered Knowledge Holder names available from DAA	792342mE 7537149mN Zone 49 [Unreliable]	P06166
6756	OSPREY BAY INTERDUNAL 2	No	No	No Gender Restrictions	Registered Site	Midden / Scatter	*Registered Knowledge Holder names available from DAA	792642mE 7537149mN Zone 49 [Reliable]	P06167
6757	BLOODWOOD CREEK MIDDEN 1	No	No	No Gender Restrictions	Registered Site	Artefacts / Scatter, Midden / Scatter	*Registered Knowledge Holder names available from DAA	794942mE 7544549mN Zone 49 [Reliable]	P06168
6758	BLOODWOOD CREEK MIDDEN 2	No	No	No Gender Restrictions	Registered Site	Artefacts / Scatter, Midden / Scatter	*Registered Knowledge Holder names available from DAA	794942mE 7545049mN Zone 49 [Reliable]	P06169
6759	BLOODWOOD CREEK MIDDEN 3	No	No	No Gender Restrictions	Registered Site	Artefacts / Scatter, Midden / Scatter	*Registered Knowledge Holder names available from DAA	795142mE 7544949mN Zone 49 [Reliable]	P06170

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6760	BLOODWOOD CREEK SHORELINE	No	No	No Gender Restrictions	Registered Site	Artefacts / Scatter, Midden / Scatter	*Registered Knowledge Holder names available from DAA	794942mE 7545249mN Zone 49 [Reliable]	P06171
6761	LOW POINT MIDDEN	No	No	No Gender Restrictions	Registered Site	Artefacts / Scatter, Midden / Scatter	*Registered Knowledge Holder names available from DAA	802992mE 7566299mN Zone 49 [Reliable]	P06172
6762	MILYERING MIDDEN	No	No	No Gender Restrictions	Registered Site	Artefacts / Scatter, Midden / Scatter	*Registered Knowledge Holder names available from DAA	801342mE 7561449mN Zone 49 [Reliable]	P06173
6763	YARDIE ROCKSHELTERS NORTH.	No	No	No Gender Restrictions	Registered Site	Artefacts / Scatter, Midden / Scatter, Rockshelter	*Registered Knowledge Holder names available from DAA	791542mE 7530249mN Zone 49 [Unreliable]	P06174
6764	CAMP 17 SOUTH MIDDENS	No	No	No Gender Restrictions	Registered Site	Artefacts / Scatter, Midden / Scatter	*Registered Knowledge Holder names available from DAA	799042mE 7555649mN Zone 49 [Unreliable]	P06175
6765	CAMP 17 NORTH MIDDENS	No	No	No Gender Restrictions	Registered Site	Artefacts / Scatter, Midden / Scatter	*Registered Knowledge Holder names available from DAA	799042mE 7555849mN Zone 49 [Unreliable]	P06176
6782	28 MILE CREEK NORTH 1	No	No	No Gender Restrictions	Registered Site	Artefacts / Scatter, Midden / Scatter	*Registered Knowledge Holder names available from DAA	795242mE 7545949mN Zone 49 [Unreliable]	P06140
6784	MANDU MANDU CREEK SOUTH	No	No	No Gender Restrictions	Registered Site	Artefacts / Scatter, Midden / Scatter	*Registered Knowledge Holder names available from DAA	796642mE 7548649mN Zone 49 [Unreliable]	P06142
6785	MANDU MANDU CREEK NORTH	No	No	No Gender Restrictions	Registered Site	Artefacts / Scatter, Midden / Scatter	*Registered Knowledge Holder names available from DAA	796642mE 7548649mN Zone 49 [Unreliable]	P06143
6787	MANDU MANDU ROCKSHELTERS.	No	No	No Gender Restrictions	Registered Site	Artefacts / Scatter, Midden / Scatter, Rockshelter, Arch Deposit, Other: ?	*Registered Knowledge Holder names available from DAA	797242mE 7547449mN Zone 49 [Reliable]	P06145
6790	YARDIE CREEK SOUTH 1	No	No	No Gender Restrictions	Registered Site	Artefacts / Scatter, Midden / Scatter	*Registered Knowledge Holder names available from DAA	788942mE 7527749mN Zone 49 [Reliable]	P06148
6791	YARDIE CREEK SOUTH 2	No	No	No Gender Restrictions	Registered Site	Artefacts / Scatter, Midden / Scatter	*Registered Knowledge Holder names available from DAA	790342mE 7528149mN Zone 49 [Reliable]	P06149

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6793	ROAD ALIGNMENT 1	No	No	No Gender Restrictions	Registered Site	Artefacts / Scatter, Midden / Scatter	*Registered Knowledge Holder names available from DAA	794942mE 7541649mN Zone 49 [Unreliable]	P06151
6794	ROAD ALIGNMENT 2	No	No	No Gender Restrictions	Registered Site	Artefacts / Scatter, Midden / Scatter	*Registered Knowledge Holder names available from DAA	794942mE 7541449mN Zone 49 [Unreliable]	P06152
6795	ROAD ALIGNMENT 3	No	No	No Gender Restrictions	Registered Site	Midden / Scatter	*Registered Knowledge Holder names available from DAA	794842mE 7541249mN Zone 49 [Reliable]	P06153
6797	YARDIE WELL ROCKSHELTER.	No	No	No Gender Restrictions	Registered Site	Artefacts / Scatter, Midden / Scatter, Rockshelter, Arch Deposit, BP Dating: 10, 490+/-180BP, Other: ?	*Registered Knowledge Holder names available from DAA	791542mE 7530449mN Zone 49 [Reliable]	P06155
6798	YARDIE INTERDUNAL SWALE	No	No	No Gender Restrictions	Registered Site	Artefacts / Scatter, Midden / Scatter	*Registered Knowledge Holder names available from DAA	789942mE 7528849mN Zone 49 [Reliable]	P06156
6799	YARDIE BEACH MIDDEN	No	No	No Gender Restrictions	Registered Site	Artefacts / Scatter, Midden / Scatter	*Registered Knowledge Holder names available from DAA	789842mE 7529049mN Zone 49 [Reliable]	P06157
6800	OYSTER STACKS MIDDEN	No	No	No Gender Restrictions	Registered Site	Artefacts / Scatter, Midden / Scatter	*Registered Knowledge Holder names available from DAA	797042mE 7549849mN Zone 49 [Reliable]	P06158
6801	NORTH T-BONE BAY	No	No	No Gender Restrictions	Registered Site	Artefacts / Scatter, Midden / Scatter	*Registered Knowledge Holder names available from DAA	801666mE 7562059mN Zone 49 [Reliable]	P06159
6802	OSPREY BAY 1	No	No	No Gender Restrictions	Registered Site	Artefacts / Scatter, Midden / Scatter	*Registered Knowledge Holder names available from DAA	792742mE 7538149mN Zone 49 [Reliable]	P06160
6803	OSPREY BAY 2	No	No	No Gender Restrictions	Registered Site	Artefacts / Scatter, Midden / Scatter	*Registered Knowledge Holder names available from DAA	792742mE 7538049mN Zone 49 [Reliable]	P06161
6804	OSPREY BAY 3	No	No	No Gender Restrictions	Registered Site	Artefacts / Scatter, Midden / Scatter	*Registered Knowledge Holder names available from DAA	792542mE 7537849mN Zone 49 [Reliable]	P06162
6805	OSPREY BAY 4	No	No	No Gender Restrictions	Registered Site	Artefacts / Scatter, Midden / Scatter	*Registered Knowledge Holder names available from DAA	792342mE 7537049mN Zone 49 [Reliable]	P06163

ID	Name	File Restricted	Boundary Restricted	Restrictions	Status	Type	Knowledge Holders	Coordinate	Legacy ID
6806	OSPREY BAY 5	No	No	No Gender Restrictions	Registered Site	Artefacts / Scatter, Midden / Scatter	*Registered Knowledge Holder names available from DAA	792742mE 7538149mN Zone 49 [Reliable]	P06164
7057	URALA MIDDEN 1	No	No	No Gender Restrictions	Registered Site	Artefacts / Scatter, Midden / Scatter	*Registered Knowledge Holder names available from DAA	273638mE 7589705mN Zone 50 [Reliable]	P05888
7058	URALA MIDDEN 2	No	No	No Gender Restrictions	Registered Site	Artefacts / Scatter, Midden / Scatter	*Registered Knowledge Holder names available from DAA	276038mE 7590655mN Zone 50 [Reliable]	P05889
7059	FOUR MILE CREEK MIDDEN	No	No	No Gender Restrictions	Registered Site	Midden / Scatter	*Registered Knowledge Holder names available from DAA	298839mE 7600855mN Zone 50 [Unreliable]	P05890
7126	MESA CAMP	No	No	No Gender Restrictions	Registered Site	Artefacts / Scatter, Midden / Scatter	*Registered Knowledge Holder names available from DAA	798442mE 7554749mN Zone 49 [Unreliable]	P05792
7175	WONANGARRA 3	No	No	No Gender Restrictions	Registered Site	Artefacts / Scatter	*Registered Knowledge Holder names available from DAA	283838mE 7564055mN Zone 50 [Reliable]	P05732
7176	WONANGARRA 4	No	No	No Gender Restrictions	Registered Site	Artefacts / Scatter	*Registered Knowledge Holder names available from DAA	284838mE 7564255mN Zone 50 [Reliable]	P05733
7177	WADAWAN 1	No	No	No Gender Restrictions	Registered Site	Artefacts / Scatter	*Registered Knowledge Holder names available from DAA	273938mE 7560055mN Zone 50 [Reliable]	P05734
7178	WADAWAN 2	No	No	No Gender Restrictions	Registered Site	Artefacts / Scatter	*Registered Knowledge Holder names available from DAA	266938mE 7546155mN Zone 50 [Reliable]	P05735
7179	WADAWAN 3	No	No	No Gender Restrictions	Registered Site	Artefacts / Scatter	*Registered Knowledge Holder names available from DAA	267238mE 7543455mN Zone 50 [Reliable]	P05736
7206	WEALJUGOO MIDDEN.	No	No	No Gender Restrictions	Registered Site	Artefacts / Scatter, Midden / Scatter, Camp, Hunting Place	*Registered Knowledge Holder names available from DAA	776584mE 7504740mN Zone 49 [Reliable]	P05710
7221	MUNGAROO POOL WEST	No	No	No Gender Restrictions	Registered Site	Artefacts / Scatter	*Registered Knowledge Holder names available from DAA	294439mE 7572155mN Zone 50 [Reliable]	P05725

ID	Name	File Restricted	Boundary Restricted	Restrictions	Status	Type	Knowledge Holders	Coordinate	Legacy ID
7222	WYLOO WELL SOUTH	No	No	No Gender Restrictions	Registered Site	Artefacts / Scatter	*Registered Knowledge Holder names available from DAA	292539mE 7572955mN Zone 50 [Unreliable]	P05726
7223	WONANGARRA 5	No	No	No Gender Restrictions	Registered Site	Artefacts / Scatter	*Registered Knowledge Holder names available from DAA	281938mE 7565855mN Zone 50 [Unreliable]	P05727
7224	OLD MINDEROO 1	No	No	No Gender Restrictions	Registered Site	Artefacts / Scatter	*Registered Knowledge Holder names available from DAA	292839mE 7582655mN Zone 50 [Unreliable]	P05728
7225	OLD MINDEROO 2	No	No	No Gender Restrictions	Registered Site	Artefacts / Scatter	*Registered Knowledge Holder names available from DAA	293639mE 7581655mN Zone 50 [Unreliable]	P05729
7226	WONANGARRA 1	No	No	No Gender Restrictions	Registered Site	Artefacts / Scatter	*Registered Knowledge Holder names available from DAA	284838mE 7562855mN Zone 50 [Reliable]	P05730
7227	WONANGARRA 2	No	No	No Gender Restrictions	Registered Site	Artefacts / Scatter	*Registered Knowledge Holder names available from DAA	283938mE 7562755mN Zone 50 [Reliable]	P05731
7254	SANDY BAY NORTH	No	No	No Gender Restrictions	Registered Site	Artefacts / Scatter, Midden / Scatter	*Registered Knowledge Holder names available from DAA	793442mE 7539949mN Zone 49 [Reliable]	P05652
7265	LAKE SIDE VIEW	No	No	No Gender Restrictions	Registered Site	Artefacts / Scatter, Midden / Scatter	*Registered Knowledge Holder names available from DAA	800942mE 7560549mN Zone 49 [Reliable]	P05664
7266	WALKING TRAIL SITE 1	No	No	No Gender Restrictions	Registered Site	Artefacts / Scatter	*Registered Knowledge Holder names available from DAA	192638mE 7555655mN Zone 50 [Unreliable]	P05665
7286	KAPOK WELL BURIAL	Yes	Yes	No Gender Restrictions	Registered Site	Skeletal Material / Burial	*Registered Knowledge Holder names available from DAA	Not available when location is restricted	P05632
7298	YARDIE CREEK ROCKSHELTERS	No	No	No Gender Restrictions	Registered Site	Artefacts / Scatter	*Registered Knowledge Holder names available from DAA	790635mE 7529704mN Zone 49 [Reliable]	P05644
7299	YARDIE CREEK	No	No	No Gender Restrictions	Registered Site	Artefacts / Scatter, Midden / Scatter	*Registered Knowledge Holder names available from DAA	789642mE 7528649mN Zone 49 [Unreliable]	P05645

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7300	MANDU MANDU CK ROCKSHELTERS	Yes	Yes	No Gender Restrictions	Registered Site	Artefacts / Scatter	*Registered Knowledge Holder names available from DAA	Not available when location is restricted	P05646
7301	CAMP 17 CREEK EAST	No	No	No Gender Restrictions	Registered Site	Artefacts / Scatter, Midden / Scatter	*Registered Knowledge Holder names available from DAA	800342mE 7555749mN Zone 49 [Reliable]	P05647
7303	TULKI WELL MIDDEN	No	No	No Gender Restrictions	Registered Site	Artefacts / Scatter, Midden / Scatter	*Registered Knowledge Holder names available from DAA	798642mE 7554249mN Zone 49 [Reliable]	P05649
7304	PILGRAMUNNA BAY MIDDEN	No	No	No Gender Restrictions	Registered Site	Artefacts / Scatter, Midden / Scatter	*Registered Knowledge Holder names available from DAA	794642mE 7543349mN Zone 49 [Reliable]	P05650
7305	MANGROVE BAY.	No	No	No Gender Restrictions	Registered Site	Artefacts / Scatter, Midden / Scatter, Skeletal Material / Burial, Hunting Place	*Registered Knowledge Holder names available from DAA	804142mE 7568149mN Zone 49 [Reliable]	P05651
7332	URALA STATION 12	No	No	No Gender Restrictions	Registered Site	Artefacts / Scatter, Midden / Scatter	*Registered Knowledge Holder names available from DAA	282038mE 7597555mN Zone 50 [Reliable]	P05574
7334	URALA STATION 14	No	No	No Gender Restrictions	Registered Site	Artefacts / Scatter, Midden / Scatter	*Registered Knowledge Holder names available from DAA	282538mE 7597255mN Zone 50 [Reliable]	P05576
7362	OLD ONSLOW MIDDEN	No	No	No Gender Restrictions	Registered Site	Artefacts / Scatter, Midden / Scatter	*Registered Knowledge Holder names available from DAA	288130mE 7597680mN Zone 50 [Reliable]	P05550
7371	URALA STATION CROSSING 1	No	No	No Gender Restrictions	Registered Site	Artefacts / Scatter, Midden / Scatter	*Registered Knowledge Holder names available from DAA	286838mE 7594455mN Zone 50 [Reliable]	P05559
7372	URALA STATION CROSSING 2	No	No	No Gender Restrictions	Registered Site	Artefacts / Scatter, Midden / Scatter	*Registered Knowledge Holder names available from DAA	287838mE 7592955mN Zone 50 [Reliable]	P05560
7373	URALA STATION 01	No	No	No Gender Restrictions	Registered Site	Artefacts / Scatter, Midden / Scatter	*Registered Knowledge Holder names available from DAA	279638mE 7588955mN Zone 50 [Reliable]	P05561
7374	URALA STATION 02.	No	No	No Gender Restrictions	Registered Site	Artefacts / Scatter, Midden / Scatter, Camp	*Registered Knowledge Holder names available from DAA	279938mE 7590355mN Zone 50 [Reliable]	P05562

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7379	URALA STATION 07	No	No	No Gender Restrictions	Registered Site	Artefacts / Scatter, Midden / Scatter	*Registered Knowledge Holder names available from DAA	284638mE 7595755mN Zone 50 [Reliable]	P05567
7381	URALA STATION 09	No	No	No Gender Restrictions	Registered Site	Artefacts / Scatter, Midden / Scatter, Skeletal Material / Burial, Camp	*Registered Knowledge Holder names available from DAA	277045mE 7592515mN Zone 50 [Reliable]	P05569
7382	ROCKY POINT MIDDEN COMPLEX	No	No	No Gender Restrictions	Registered Site	Artefacts / Scatter, Midden / Scatter	*Registered Knowledge Holder names available from DAA	278538mE 7594655mN Zone 50 [Reliable]	P05570
7383	ROCKY POINT EAST	No	No	No Gender Restrictions	Registered Site	Artefacts / Scatter, Midden / Scatter	*Registered Knowledge Holder names available from DAA	279238mE 7594855mN Zone 50 [Reliable]	P05571
7384	URALA STATION 10	No	No	No Gender Restrictions	Registered Site	Midden / Scatter	*Registered Knowledge Holder names available from DAA	280238mE 7593955mN Zone 50 [Reliable]	P05572
7385	URALA STATION 11	No	No	No Gender Restrictions	Registered Site	Artefacts / Scatter, Midden / Scatter	*Registered Knowledge Holder names available from DAA	282238mE 7597555mN Zone 50 [Reliable]	P05573
7407	CLAYPAN WELL 1	No	No	No Gender Restrictions	Registered Site	Artefacts / Scatter	*Registered Knowledge Holder names available from DAA	345339mE 7550955mN Zone 50 [Unreliable]	P05541
7409	CLAYPAN WELL 3	No	No	No Gender Restrictions	Registered Site	Artefacts / Scatter	*Registered Knowledge Holder names available from DAA	342272mE 7557871mN Zone 50 [Reliable]	P05543
7410	CLAYPAN WELL 4	No	No	No Gender Restrictions	Registered Site	Artefacts / Scatter	*Registered Knowledge Holder names available from DAA	338173mE 7562272mN Zone 50 [Reliable]	P05544
7557	BORROW AREA 3-2	No	No	No Gender Restrictions	Registered Site	Artefacts / Scatter	*Registered Knowledge Holder names available from DAA	329839mE 7510855mN Zone 50 [Reliable]	P05371
7558	BORROW AREA 3-3.	No	No	No Gender Restrictions	Registered Site	Artefacts / Scatter, Grinding Patches / Grooves, Rockshelter, Arch Deposit	*Registered Knowledge Holder names available from DAA	327939mE 7509555mN Zone 50 [Reliable]	P05372
8054	97 MILE KNOLL.	No	No	No Gender Restrictions	Registered Site	Artefacts / Scatter, Quarry, Rockshelter, Arch Deposit	*Registered Knowledge Holder names available from DAA	344548mE 7555453mN Zone 50 [Reliable]	P04602

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ID	Name	File Restricted	Boundary Restricted	Restrictions	Status	Type	Knowledge Holders	Coordinate	Legacy ID
8055	STOCKPILE 3 CAMP	No	No	No Gender Restrictions	Registered Site	Artefacts / Scatter	*Registered Knowledge Holder names available from DAA	345639mE 7557655mN Zone 50 [Unreliable]	P04603
8299	BEADON CREEK	No	No	No Gender Restrictions	Registered Site	Artefacts / Scatter, Skeletal Material / Burial	*Registered Knowledge Holder names available from DAA	313139mE 7609155mN Zone 50 [Reliable]	P04351
8307	MANYINGEE HILL	No	No	No Gender Restrictions	Registered Site	Artefacts / Scatter, Quarry	*Registered Knowledge Holder names available from DAA	315093mE 7517248mN Zone 50 [Reliable]	P04359
8308	DRILL HOLE SLO-R-257	No	No	No Gender Restrictions	Registered Site	Artefacts / Scatter, Quarry	*Registered Knowledge Holder names available from DAA	313639mE 7532655mN Zone 50 [Unreliable]	P04360
8907	NATGAS 151	No	No	No Gender Restrictions	Registered Site	Artefacts / Scatter	*Registered Knowledge Holder names available from DAA	318339mE 7512255mN Zone 50 [Reliable]	P03605
8911	NATGAS 155	No	No	No Gender Restrictions	Registered Site	Artefacts / Scatter	*Registered Knowledge Holder names available from DAA	352739mE 7565155mN Zone 50 [Reliable]	P03609
8920	ONSLOW 1	No	No	No Gender Restrictions	Registered Site	Artefacts / Scatter, Midden / Scatter	*Registered Knowledge Holder names available from DAA	304068mE 7606217mN Zone 50 [Reliable]	P03563
10381	VLAMING HEAD	Yes	Yes	No Gender Restrictions	Registered Site	Ceremonial, Mythological	*Registered Knowledge Holder names available from DAA	Not available when location is restricted	P01799
10543	GAS PIPELINE 46	No	No	No Gender Restrictions	Registered Site	Artefacts / Scatter, Engraving, Grinding Patches / Grooves	*Registered Knowledge Holder names available from DAA	332639mE 7538655mN Zone 50 [Unreliable]	P01649
10544	GAS PIPELINE 47	No	No	No Gender Restrictions	Registered Site	Artefacts / Scatter, Grinding Patches / Grooves	*Registered Knowledge Holder names available from DAA	329639mE 7532655mN Zone 50 [Unreliable]	P01650
10545	GAS PIPELINE 48	No	No	No Gender Restrictions	Registered Site	Artefacts / Scatter, Grinding Patches / Grooves	*Registered Knowledge Holder names available from DAA	329639mE 7532655mN Zone 50 [Unreliable]	P01651
10546	GAS PIPELINE 49	No	No	No Gender Restrictions	Registered Site	Artefacts / Scatter, Grinding Patches / Grooves	*Registered Knowledge Holder names available from DAA	329639mE 7532655mN Zone 50 [Unreliable]	P01652

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ID	Name	File Restricted	Boundary Restricted	Restrictions	Status	Type	Knowledge Holders	Coordinate	Legacy ID
10548	GAS PIPELINE 51	No	No	No Gender Restrictions	Registered Site	Artefacts / Scatter, Grinding Patches / Grooves	*Registered Knowledge Holder names available from DAA	325639mE 7524655mN Zone 50 [Unreliable]	P01654
10549	GAS PIPELINE 52	No	No	No Gender Restrictions	Registered Site	Artefacts / Scatter, Grinding Patches / Grooves	*Registered Knowledge Holder names available from DAA	322639mE 7521655mN Zone 50 [Unreliable]	P01655
11025	NANUTARRA.	No	No	No Gender Restrictions	Registered Site	Artefacts / Scatter, Ceremonial, Camp	*Registered Knowledge Holder names available from DAA	345639mE 7506154mN Zone 50 [Reliable]	P01124
11063	TERMINAL ISLAND	No	No	No Gender Restrictions	Registered Site	Man-Made Structure	*Registered Knowledge Holder names available from DAA	245952mE 7554671mN Zone 50 [Unreliable]	P01109
11064	URAMA.	Yes	Yes	No Gender Restrictions	Registered Site	Artefacts / Scatter, Camp, Water Source	*Registered Knowledge Holder names available from DAA	Not available when location is restricted	P01110
11068	PEEPINGEE ROCKS.	No	No	No Gender Restrictions	Registered Site	Artefacts / Scatter, Ceremonial, Grinding Patches / Grooves, Camp, Water Source	*Registered Knowledge Holder names available from DAA	318639mE 7518655mN Zone 50 [Unreliable]	P01114
11400	YARDIE CREEK STATION	No	No	No Gender Restrictions	Registered Site	Engraving	*Registered Knowledge Holder names available from DAA	191638mE 7576655mN Zone 50 [Unreliable]	P00750
11401	5 Mile Well (Cape Range)	No	No	No Gender Restrictions	Registered Site	Artefacts / Scatter, Engraving, Painting, Quarry, Arch Deposit	*Registered Knowledge Holder names available from DAA	198638mE 7583655mN Zone 50 [Unreliable]	P00751
11402	URALA DUNE BURIAL	Yes	Yes	No Gender Restrictions	Registered Site	Artefacts / Scatter, Midden / Scatter, Skeletal Material / Burial	*Registered Knowledge Holder names available from DAA	Not available when location is restricted	P00752
11404	GOODINGOO ROCKS	No	No	No Gender Restrictions	Registered Site	Artefacts / Scatter, Engraving	*Registered Knowledge Holder names available from DAA	322639mE 7538655mN Zone 50 [Unreliable]	P00754
11405	CANE RIVER	No	No	No Gender Restrictions	Registered Site	Man-Made Structure	*Registered Knowledge Holder names available from DAA	335661mE 7592235mN Zone 50 [Reliable]	P00755
11458	NINGALOO (near)	No	No	No Gender Restrictions	Registered Site	Painting	*Registered Knowledge Holder names available from DAA	781642mE 7511649mN Zone 49 [Unreliable]	P00701

ID	Name	File Restricted	Boundary Restricted	Restrictions	Status	Type	Knowledge Holders	Coordinate	Legacy ID
11885	PADJARI MANU CAVE (Formerly Bunbury Cave)	Yes	Yes	No Gender Restrictions	Registered Site	Artefacts / Scatter, Ceremonial, Engraving, Painting, Arch Deposit, Water Source	*Registered Knowledge Holder names available from DAA	Not available when location is restricted	P00267
15310	WYLOO DAM 05	No	No	No Gender Restrictions	Registered Site	Artefacts / Scatter	*Registered Knowledge Holder names available from DAA	280317mE 7581631mN Zone 50 [Reliable]	P07910
15311	WYLOO DAM 06	No	No	No Gender Restrictions	Registered Site	Artefacts / Scatter	*Registered Knowledge Holder names available from DAA	280416mE 7580447mN Zone 50 [Reliable]	P07911
15314	WYLOO DAM 09	No	No	No Gender Restrictions	Registered Site	Artefacts / Scatter	*Registered Knowledge Holder names available from DAA	281808mE 7580925mN Zone 50 [Reliable]	P07914
15322	POINT MURAT/WHITE OPAL	No	No	No Gender Restrictions	Registered Site	Artefacts / Scatter, Midden / Scatter	*Registered Knowledge Holder names available from DAA	209012mE 7585213mN Zone 50 [Reliable]	P07916
15842	AMETHYST 01	No	No	No Gender Restrictions	Registered Site	Midden / Scatter	*Registered Knowledge Holder names available from DAA	293170mE 7594168mN Zone 50 [Reliable]	
15843	AMETHYST 02	No	No	No Gender Restrictions	Registered Site	Artefacts / Scatter, Midden / Scatter	*Registered Knowledge Holder names available from DAA	292019mE 7562539mN Zone 50 [Reliable]	
15844	AMETHYST 03	No	No	No Gender Restrictions	Registered Site	Artefacts / Scatter, Midden / Scatter	*Registered Knowledge Holder names available from DAA	293272mE 7591228mN Zone 50 [Reliable]	
15846	AMETHYST 05	No	No	No Gender Restrictions	Registered Site	Midden / Scatter	*Registered Knowledge Holder names available from DAA	294058mE 7594447mN Zone 50 [Reliable]	
15847	AMETHYST 06	No	No	No Gender Restrictions	Registered Site	Midden / Scatter	*Registered Knowledge Holder names available from DAA	294420mE 7594115mN Zone 50 [Reliable]	
15926	TUBRIDGI 01	No	No	No Gender Restrictions	Registered Site	Artefacts / Scatter, Midden / Scatter, Shell	*Registered Knowledge Holder names available from DAA	277811mE 7593977mN Zone 50 [Reliable]	
15927	TUBRIDGI 02	No	No	No Gender Restrictions	Registered Site	Artefacts / Scatter, Midden / Scatter, Shell	*Registered Knowledge Holder names available from DAA	277849mE 7593901mN Zone 50 [Reliable]	

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ID	Name	File Restricted	Boundary Restricted	Restrictions	Status	Type	Knowledge Holders	Coordinate	Legacy ID
15928	TUBRIDGI 04	No	No	No Gender Restrictions	Registered Site	Artefacts / Scatter, Shell	*Registered Knowledge Holder names available from DAA	277838mE 7593830mN Zone 50 [Reliable]	
15929	TUBRIDGI 05	No	No	No Gender Restrictions	Registered Site	Artefacts / Scatter, Shell	*Registered Knowledge Holder names available from DAA	277834mE 7593689mN Zone 50 [Reliable]	
15930	TUBRIDGI 06	No	No	No Gender Restrictions	Registered Site	Midden / Scatter, Shell	*Registered Knowledge Holder names available from DAA	277865mE 7593559mN Zone 50 [Reliable]	
15931	TUBRIDGI 07	No	No	No Gender Restrictions	Registered Site	Midden / Scatter, Shell	*Registered Knowledge Holder names available from DAA	277927mE 7593473mN Zone 50 [Reliable]	
15932	TUBRIDGI 08	No	No	No Gender Restrictions	Registered Site	Artefacts / Scatter, Midden / Scatter, Shell	*Registered Knowledge Holder names available from DAA	277947mE 7593417mN Zone 50 [Reliable]	
15933	TUBRIDGI 09	No	No	No Gender Restrictions	Registered Site	Artefacts / Scatter, Midden / Scatter, Shell	*Registered Knowledge Holder names available from DAA	277969mE 7593332mN Zone 50 [Reliable]	
16792	Site A	No	No	No Gender Restrictions	Registered Site	Midden / Scatter, Shell	*Registered Knowledge Holder names available from DAA	272938mE 7590455mN Zone 50 [Unreliable]	
16793	Site B	No	No	No Gender Restrictions	Registered Site	Midden / Scatter, Shell	*Registered Knowledge Holder names available from DAA	274238mE 7591605mN Zone 50 [Unreliable]	
17192	Exmouth Station	No	No	No Gender Restrictions	Registered Site	Skeletal Material / Burial	*Registered Knowledge Holder names available from DAA	209138mE 7525654mN Zone 50 [Unreliable]	
17447	PAP HILL OCHRE	No	No	No Gender Restrictions	Registered Site	Ceremonial, Grinding Patches / Grooves, Rockshelter, Ochre	*Registered Knowledge Holder names available from DAA	198327mE 7581741mN Zone 50 [Reliable]	
17448	CHUGORI ROCKHOLE	No	No	No Gender Restrictions	Registered Site	Ceremonial, Grinding Patches / Grooves, Man-Made Structure, Mythological, Water Source	*Registered Knowledge Holder names available from DAA	193492mE 7579323mN Zone 50 [Reliable]	
18030	Pipeline Corridor 37 (PC-37)	No	No	No Gender Restrictions	Registered Site	Artefacts / Scatter	*Registered Knowledge Holder names available from DAA	320629mE 7517043mN Zone 50 [Reliable]	

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ID	Name	File Restricted	Boundary Restricted	Restrictions	Status	Type	Knowledge Holders	Coordinate	Legacy ID
18031	Pipeline Corridor 38 (PC-38)	No	No	No Gender Restrictions	Registered Site	Artefacts / Scatter	*Registered Knowledge Holder names available from DAA	320696mE 7516546mN Zone 50 [Reliable]	
19740	Ashburton River Bridge Project 04	No	No	No Gender Restrictions	Registered Site	Artefacts / Scatter	*Registered Knowledge Holder names available from DAA	346358mE 7506568mN Zone 50 [Reliable]	
19741	Ashburton River Bridge Site 05	No	No	No Gender Restrictions	Registered Site	Artefacts / Scatter	*Registered Knowledge Holder names available from DAA	345264mE 7505973mN Zone 50 [Reliable]	
19743	Ashburton River Bridge Site 07	No	No	No Gender Restrictions	Registered Site	Artefacts / Scatter	*Registered Knowledge Holder names available from DAA	345567mE 7506333mN Zone 50 [Reliable]	
21606	Roller/Skate Site 5	No	No	No Gender Restrictions	Registered Site	Artefacts / Scatter, Shell	*Registered Knowledge Holder names available from DAA	281238mE 7595354mN Zone 50 [Reliable]	
21607	Roller/Skate Site 2	No	No	No Gender Restrictions	Registered Site	Midden / Scatter, Shell	*Registered Knowledge Holder names available from DAA	281838mE 7597255mN Zone 50 [Reliable]	
21608	Roller/Skate Site 3	No	No	No Gender Restrictions	Registered Site	Midden / Scatter, Shell	*Registered Knowledge Holder names available from DAA	281338mE 7595655mN Zone 50 [Reliable]	
21609	Roller/Skate Site 4	No	No	No Gender Restrictions	Registered Site	Artefacts / Scatter, Midden / Scatter, Shell	*Registered Knowledge Holder names available from DAA	281301mE 7595354mN Zone 50 [Unreliable]	
28594	Wheatstone 12	No	No	No Gender Restrictions	Registered Site	Artefacts / Scatter	*Registered Knowledge Holder names available from DAA	296611mE 7590005mN Zone 50 [Reliable]	
28599	Wheatstone 16	No	No	No Gender Restrictions	Registered Site	Artefacts / Scatter	*Registered Knowledge Holder names available from DAA	296695mE 7589720mN Zone 50 [Reliable]	
28603	Wheatstone 17	No	No	No Gender Restrictions	Registered Site	Artefacts / Scatter	*Registered Knowledge Holder names available from DAA	296966mE 7589157mN Zone 50 [Reliable]	
28605	Wheatstone 19	No	No	No Gender Restrictions	Registered Site	Artefacts / Scatter	*Registered Knowledge Holder names available from DAA	297152mE 7589251mN Zone 50 [Reliable]	

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ID	Name	File Restricted	Boundary Restricted	Restrictions	Status	Type	Knowledge Holders	Coordinate	Legacy ID
28606	Wheatstone 20	No	No	No Gender Restrictions	Registered Site	Artefacts / Scatter	*Registered Knowledge Holder names available from DAA	297276mE 7589372mN Zone 50 [Reliable]	
28607	Wheatstone 21	No	No	No Gender Restrictions	Registered Site	Artefacts / Scatter	*Registered Knowledge Holder names available from DAA	297321mE 7589542mN Zone 50 [Reliable]	
28608	Wheatstone 22	No	No	No Gender Restrictions	Registered Site	Artefacts / Scatter	*Registered Knowledge Holder names available from DAA	297719mE 7589406mN Zone 50 [Reliable]	
28609	Wheatstone 23	No	No	No Gender Restrictions	Registered Site	Artefacts / Scatter	*Registered Knowledge Holder names available from DAA	297831mE 7589673mN Zone 50 [Reliable]	
28610	Wheatstone 24	No	No	No Gender Restrictions	Registered Site	Artefacts / Scatter	*Registered Knowledge Holder names available from DAA	297985mE 7589736mN Zone 50 [Reliable]	
28612	Wheatstone 26	No	No	No Gender Restrictions	Registered Site	Artefacts / Scatter	*Registered Knowledge Holder names available from DAA	297576mE 7590905mN Zone 50 [Reliable]	
28613	Wheatstone 27	No	No	No Gender Restrictions	Registered Site	Artefacts / Scatter	*Registered Knowledge Holder names available from DAA	297846mE 7589243mN Zone 50 [Reliable]	
28615	MP08-53	Yes	Yes	No Gender Restrictions	Registered Site	Ceremonial, Mythological, Water Source	*Registered Knowledge Holder names available from DAA	Not available when location is restricted	
28652	MP08 - 05	No	No	No Gender Restrictions	Registered Site	Artefacts / Scatter, Camp	*Registered Knowledge Holder names available from DAA	333847mE 7565176mN Zone 50 [Reliable]	
28660	MP08 - 17	No	No	No Gender Restrictions	Registered Site	Artefacts / Scatter, Grinding Patches / Grooves, Midden / Scatter, Camp, Shell	*Registered Knowledge Holder names available from DAA	287776mE 7592313mN Zone 50 [Reliable]	
28662	MP08 - 20	No	No	No Gender Restrictions	Registered Site	Artefacts / Scatter, Camp	*Registered Knowledge Holder names available from DAA	291307mE 7595779mN Zone 50 [Reliable]	
28663	MP08 - 21	No	No	No Gender Restrictions	Registered Site	Artefacts / Scatter, Camp	*Registered Knowledge Holder names available from DAA	291360mE 7595143mN Zone 50 [Reliable]	

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ID	Name	File Restricted	Boundary Restricted	Restrictions	Status	Type	Knowledge Holders	Coordinate	Legacy ID
28664	MP08 - 22	No	No	No Gender Restrictions	Registered Site	Artefacts / Scatter, Midden / Scatter, Camp, Shell	*Registered Knowledge Holder names available from DAA	290587mE 7595199mN Zone 50 [Reliable]	
28666	MP08 - 24	No	No	No Gender Restrictions	Registered Site	Midden / Scatter, Camp, Shell	*Registered Knowledge Holder names available from DAA	290390mE 7595308mN Zone 50 [Reliable]	
28667	MP08 - 25	No	No	No Gender Restrictions	Registered Site	Artefacts / Scatter, Camp, Shell	*Registered Knowledge Holder names available from DAA	292429mE 7594679mN Zone 50 [Reliable]	
28669	MP08 - 27	No	No	No Gender Restrictions	Registered Site	Artefacts / Scatter, Camp, Shell	*Registered Knowledge Holder names available from DAA	292349mE 7596153mN Zone 50 [Reliable]	
28670	MP08 - 28	No	No	No Gender Restrictions	Registered Site	Artefacts / Scatter, Camp, Shell	*Registered Knowledge Holder names available from DAA	292344mE 7596265mN Zone 50 [Reliable]	
28676	MP08 - 34	No	No	No Gender Restrictions	Registered Site	Artefacts / Scatter, Camp	*Registered Knowledge Holder names available from DAA	291369mE 7596469mN Zone 50 [Reliable]	
28677	MP08 - 35	No	No	No Gender Restrictions	Registered Site	Artefacts / Scatter, Grinding Patches / Grooves, Arch Deposit	*Registered Knowledge Holder names available from DAA	290313mE 7596281mN Zone 50 [Reliable]	
28678	MP08 - 36	No	No	No Gender Restrictions	Registered Site	Midden / Scatter, Camp, Shell	*Registered Knowledge Holder names available from DAA	290409mE 7596566mN Zone 50 [Reliable]	
28679	MP08 - 37	No	No	No Gender Restrictions	Registered Site	Artefacts / Scatter, Grinding Patches / Grooves, Camp	*Registered Knowledge Holder names available from DAA	290870mE 7596284mN Zone 50 [Reliable]	
28682	MP08 - 40	No	No	No Gender Restrictions	Registered Site	Artefacts / Scatter, Grinding Patches / Grooves, Camp	*Registered Knowledge Holder names available from DAA	290640mE 7595647mN Zone 50 [Reliable]	
28683	MP08 - 41	No	No	No Gender Restrictions	Registered Site	Artefacts / Scatter, Grinding Patches / Grooves, Midden / Scatter, Camp, Shell	*Registered Knowledge Holder names available from DAA	290047mE 7595888mN Zone 50 [Reliable]	
28684	MP08 - 42	No	No	No Gender Restrictions	Registered Site	Artefacts / Scatter, Grinding Patches / Grooves, Midden / Scatter, Camp, Shell	*Registered Knowledge Holder names available from DAA	290129mE 7595654mN Zone 50 [Reliable]	

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ID	Name	File Restricted	Boundary Restricted	Restrictions	Status	Type	Knowledge Holders	Coordinate	Legacy ID
28695	MP08 - 6	No	No	No Gender Restrictions	Registered Site	Midden / Scatter, Camp, Shell	*Registered Knowledge Holder names available from DAA	279310mE 7592684mN Zone 50 [Reliable]	
28700	MP08 - 50	No	No	No Gender Restrictions	Registered Site	Artefacts / Scatter, Camp	*Registered Knowledge Holder names available from DAA	277207mE 7593251mN Zone 50 [Reliable]	
28701	MP08 - 52	No	No	No Gender Restrictions	Registered Site	Artefacts / Scatter, Midden / Scatter, Camp, Shell	*Registered Knowledge Holder names available from DAA	277239mE 7593099mN Zone 50 [Reliable]	
28713	Wheatstone 1	No	No	No Gender Restrictions	Registered Site	Artefacts / Scatter, Midden / Scatter	*Registered Knowledge Holder names available from DAA	293636mE 7599855mN Zone 50 [Reliable]	
28714	Wheatstone 2	No	No	No Gender Restrictions	Registered Site	Artefacts / Scatter, Midden / Scatter, Shell	*Registered Knowledge Holder names available from DAA	293348mE 7599818mN Zone 50 [Reliable]	
28716	Wheatstone 4	No	No	No Gender Restrictions	Registered Site	Midden / Scatter, Shell	*Registered Knowledge Holder names available from DAA	292376mE 7600315mN Zone 50 [Reliable]	
29149	Loop 1-01	No	No	No Gender Restrictions	Registered Site	Artefacts / Scatter, Arch Deposit	*Registered Knowledge Holder names available from DAA	336780mE 7545238mN Zone 50 [Reliable]	
29705	Yarri 1	No	No	No Gender Restrictions	Registered Site	Artefacts / Scatter, Arch Deposit	*Registered Knowledge Holder names available from DAA	295696mE 7584064mN Zone 50 [Reliable]	
29706	Yarri 2	No	No	No Gender Restrictions	Registered Site	Artefacts / Scatter, Grinding Patches / Grooves, Arch Deposit	*Registered Knowledge Holder names available from DAA	295112mE 7580895mN Zone 50 [Reliable]	
29707	Ashburton River Artefact Scatter	No	No	No Gender Restrictions	Registered Site	Artefacts / Scatter, Arch Deposit	*Registered Knowledge Holder names available from DAA	295219mE 7575283mN Zone 50 [Reliable]	
35628	Onslow Old Law Ground	Yes	No		Registered Site	Ceremonial, Meeting Place	*Registered Knowledge Holder names available from DAA	305220mE 7605254mN Zone 50 [Reliable]	
37461	Goodingu Outcamp	No	No		Registered Site	Artefacts / Scatter, Ceremonial, Grinding Patches / Grooves, Man-Made Structure, Mythological, Quarry	*Registered Knowledge Holder names available from DAA	321581mE 7535234mN Zone 50 [Reliable]	

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ID	Name	File Restricted	Boundary Restricted	Restrictions	Status	Type	Knowledge Holders	Coordinate	Legacy ID
37462	Barlathun Artefact Scatter	No	No		Registered Site	Artefacts / Scatter	*Registered Knowledge Holder names available from DAA	317041mE 7521806mN Zone 50 [Reliable]	
37463	Warralee West Artefact Scatter	No	No		Registered Site	Artefacts / Scatter	*Registered Knowledge Holder names available from DAA	299501mE 7555882mN Zone 50 [Reliable]	
37464	Jiminu Pool Grinding Patches	No	No		Registered Site	Grinding Patches / Grooves	*Registered Knowledge Holder names available from DAA	310287mE 7539259mN Zone 50 [Reliable]	
37466	Barkatangee Artefact Scatter 2	No	No		Registered Site	Artefacts / Scatter, Ceremonial	*Registered Knowledge Holder names available from DAA	305756mE 7550630mN Zone 50 [Reliable]	
37467	Barkatangee Artefact Scatter 1	No	No		Registered Site	Artefacts / Scatter	*Registered Knowledge Holder names available from DAA	305134mE 7550752mN Zone 50 [Reliable]	
37468	Balchara Artefact Scatter	No	No		Registered Site	Artefacts / Scatter	*Registered Knowledge Holder names available from DAA	309289mE 7542832mN Zone 50 [Reliable]	
37522	Mindurru (Ashburton River)	Yes	Yes		Registered Site	Mythological	*Registered Knowledge Holder names available from DAA	Not available when location is restricted	

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GOVERNMENT OF WESTERN AUSTRALIA

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Map of Registered Aboriginal Sites

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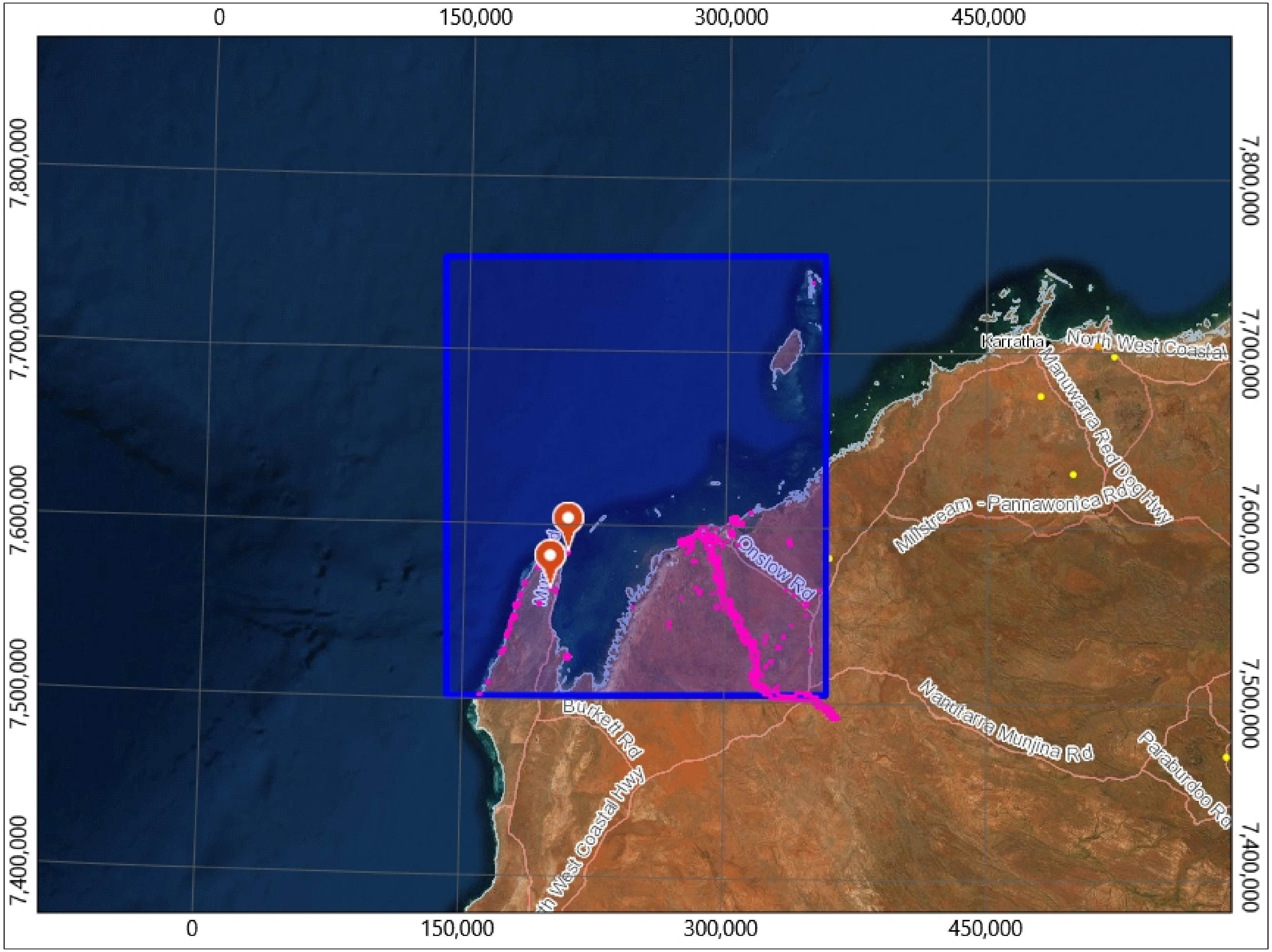

Legend

🟪 Registered Aboriginal Site
🟦 Search Area
● Town
— Road
— River
☐ Local Government Authority

117.91 kilometres

Map Scale 1 : 3,570,000

MGA Zone 50 (GDA94)

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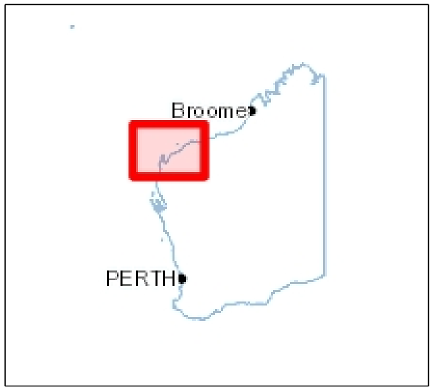

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APPENDIX H MASTER WOODSIDE EXISTING ENVIRONMENT

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1. INTRODUCTION

1.1 Purpose

This document applies, where indicated in the relevant Environment Plan, to Woodside Energy Ltd. (Woodside) activities and operations.

1.2 Scope

This document describes the existing environment within the Woodside areas of activity located in Commonwealth waters off north-western Western Australia (WA), with a focus on the North-west Marine Region (NWMR) (**Figure 1-1**). This document includes details of the particular and relevant values and sensitivities of the environment as required by the Commonwealth Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2009 in order to inform the impact and risk evaluation of Woodside's activities within the NWMR. Furthermore, the key values of the South-west Marine Region (SWMR) and the North Marine Region (NMR) are summarised to encompass areas outside the NWMR. This is with reference to the environment that may be affected (EMBA), as defined and described in individual EPs, for unplanned hydrocarbon spill risks. Additional information appropriate to the nature and scale of the impacts and risks of activities that may interact with the environment will be used to further inform impact and risk assessments and included in the Description of the Existing Environment of individual EPs.

This document is informed by a variety of resources that includes: a search of the Department of Agriculture, Water and the Environment (DAWE) Protected Matters Search Tool (PMST) for the marine bioregions (NWMR, SWMR and NMR) and the three PMST reports provided in **Appendix A**; State (WA)/Commonwealth Marine Park Management Plans, the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) Species Profile and Threats Database (SPRAT), Part 13 statutory instruments (recovery plans, conservation advices and wildlife conservation plans for listed threatened and migratory species); and peer reviewed scientific publications, as well as Woodside and Joint Venture (JV) funded studies and other titleholder funded study findings available in the public domain.

1.3 Review and Revision

The information presented in this document is reviewed and updated, where relevant, on at least an annual basis to address any relevant changes, which includes but is not limited to the status of EPBC Act listed species, Part 13 Instruments, policies and guidelines and recently published scientific literature.

1.4 Regional Context

Where relevant, the physical, biological and social environments within the areas of interest are discussed with reference to the three marine bioregions of Australia—NWMR, SWMR and NMR (**Table 1-1)**. The NWMR is the focal marine bioregion for the Description of the Existing Environment as this is currently the location of most of Woodside's activities.

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Table 1-1. Description of the Marine Bioregions

Marine Bioregion	Description
North-west	The NWMR includes all Commonwealth waters (from 3 nautical mile [nm] from the Territorial Sea Baseline [TSB] to the 200 nm Exclusive Economic Zone [EEZ] boundary) extending from the WA/Northern Territory (NT) border to Kalbarri, south of Shark Bay in WA, covering an area of approximately 1.07 million square kilometres and includes extensive areas of shallower waters on the continental shelf, as well as deep areas of abyssal plain where water depths are 5000 m or greater.
South-west	The SWMR comprises Commonwealth waters from the eastern end of Kangaroo Island in SA to Shark Bay in WA. The region spans approximately 1.3 million square kilometres of temperate and subtropical waters and abuts the coastal waters of SA and WA.
North	The NMR comprises Commonwealth waters from west Cape York Peninsula to the NT/WA border). The region covers approximately 625,689 square kilometres of tropical waters in the Gulf of Carpentaria and Arafura and Timor seas, and abuts the coastal waters of Queensland and the NT.

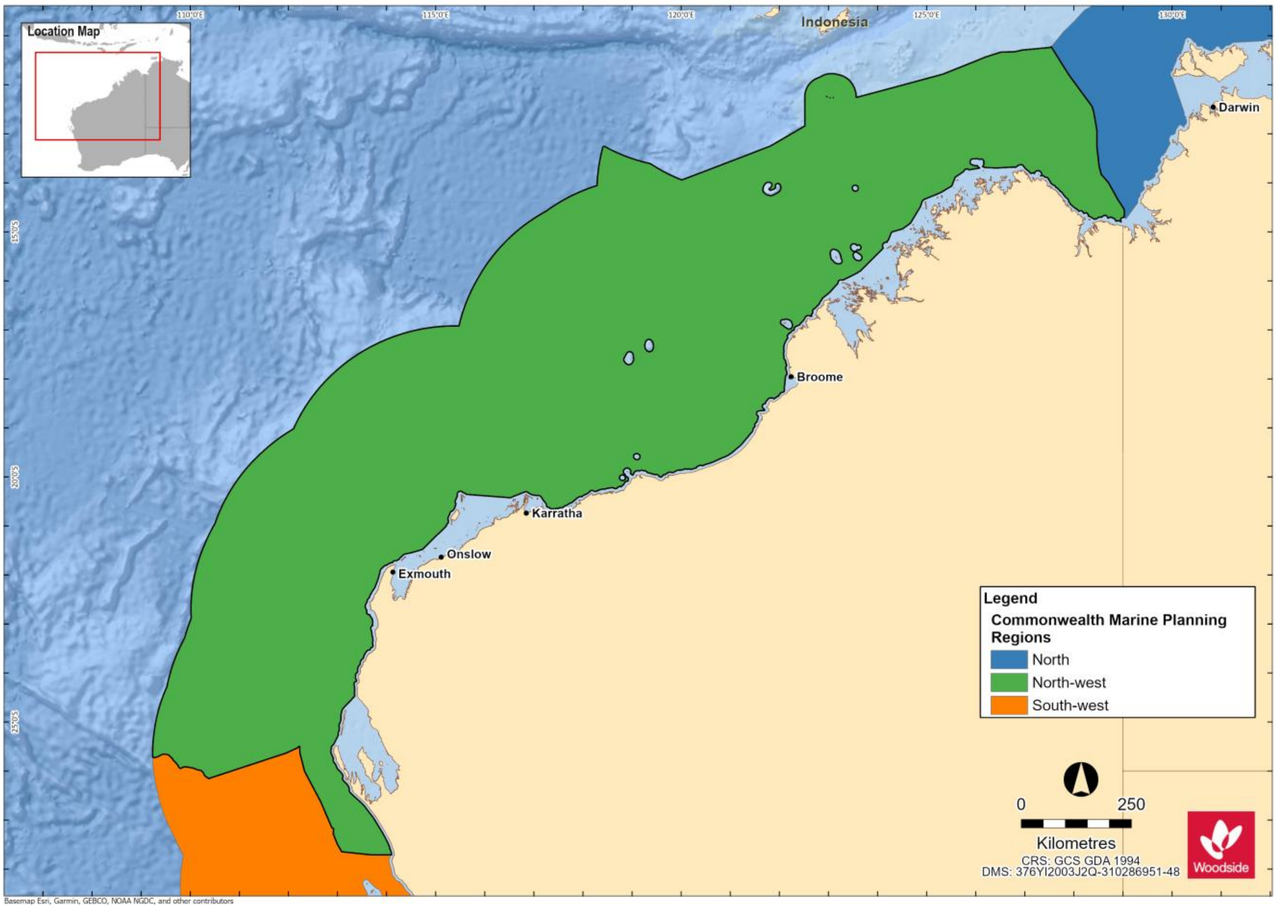

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Figure 1-1. Marine Bioregions: North-west (NWMR), South-west (SWMR) and North (NMR)

2. PHYSICAL ENVIRONMENT

2.1 Regional Context

The key physical characteristics of the NWMR, SWMR and NMR are presented in **Table 2-1**.

Table 2-1 Key physical characteristics of the NWMR, SWMR and NMR

Bioregion	Key Characteristics
North-west Marine Region	The NWMR experiences a tropical monsoonal climate towards the northern extent of the region, transitioning to tropical arid and subtropical arid within the central and southern areas of the region (DSEWPAC, 2012a).
	The NWMR is part of the Indo-Australian Basin, the ocean region between the north-west coast of Australia and the Indonesian islands of Java and Sumatra. Dominant currents in the Region include: the South Equatorial Current, the Indonesian Throughflow; the Eastern Gyral Current, and the Leeuwin Current (DEWHA, 2007a).
	The seafloor of the NWMR consists of four general feature types: continental shelf; continental slope; continental rise; and abyssal plain and is distinguished by a range of topographic features including canyons, plateaus, terraces, ridges, reefs, and banks and shoals.
South-west Marine Region	The SWMR contains both subtropical and temperate climates, with overall light climatic cycles.
	The SWMR experiences complex and unusual oceanographic patterns, driven largely by the Leeuwin Current and its associated currents that have a significant influence on biodiversity distribution and abundance.
	The major seafloor features of the SWMR include a narrow continental shelf on the west coast to the waters off south-west WA, and a wide continental shelf dominated by sandy carbonate sediments of marine origin in the Great Australian Bight, the region also contains a steep, muddy continental slope, many canyons and large tracts of abyssal plains (DSEWPAC, 2012b).
North Marine Region	The NMR experiences a tropical monsoonal climate with complex weather cycles, including high temperatures and heavy seasonal yet variable rainfall and cyclones, which can be both destructive (loss of seagrass and mangroves) and constructive (mobilisation of sediment into coastal habitats).
	The NMR comprises Commonwealth waters from west Cape York Peninsula to the NT–WA border, covering tropical waters in the Gulf of Carpentaria and Arafura and Timor seas. Currents in the NMR are driven largely by strong winds and tides, with only minor influences from oceanographic currents such as the Indonesian Throughflow and the South Equatorial Current (DSEWPAC, 2012c).
	The seafloor of the NMR consists mainly of a wide continental shelf, as well as other geomorphological features such as shoals, banks, terraces, valleys, shallow canyons and limestone pinnacles.

2.2 Marine Systems of the North-west Marine Region.

The NWMR can be divided into three large scale ecological marine systems on the basis of the influence of major ocean currents, seafloor features and eco-physical processes (e.g. climate, tides, freshwater inflow) upon the Region (DSEWPAC, 2012a). The three large scale marine systems approximate the Woodside activity areas within the NWMR (**Figure 2-1**). The key characteristics of each marine system are outlined below in **Table 2-2**.

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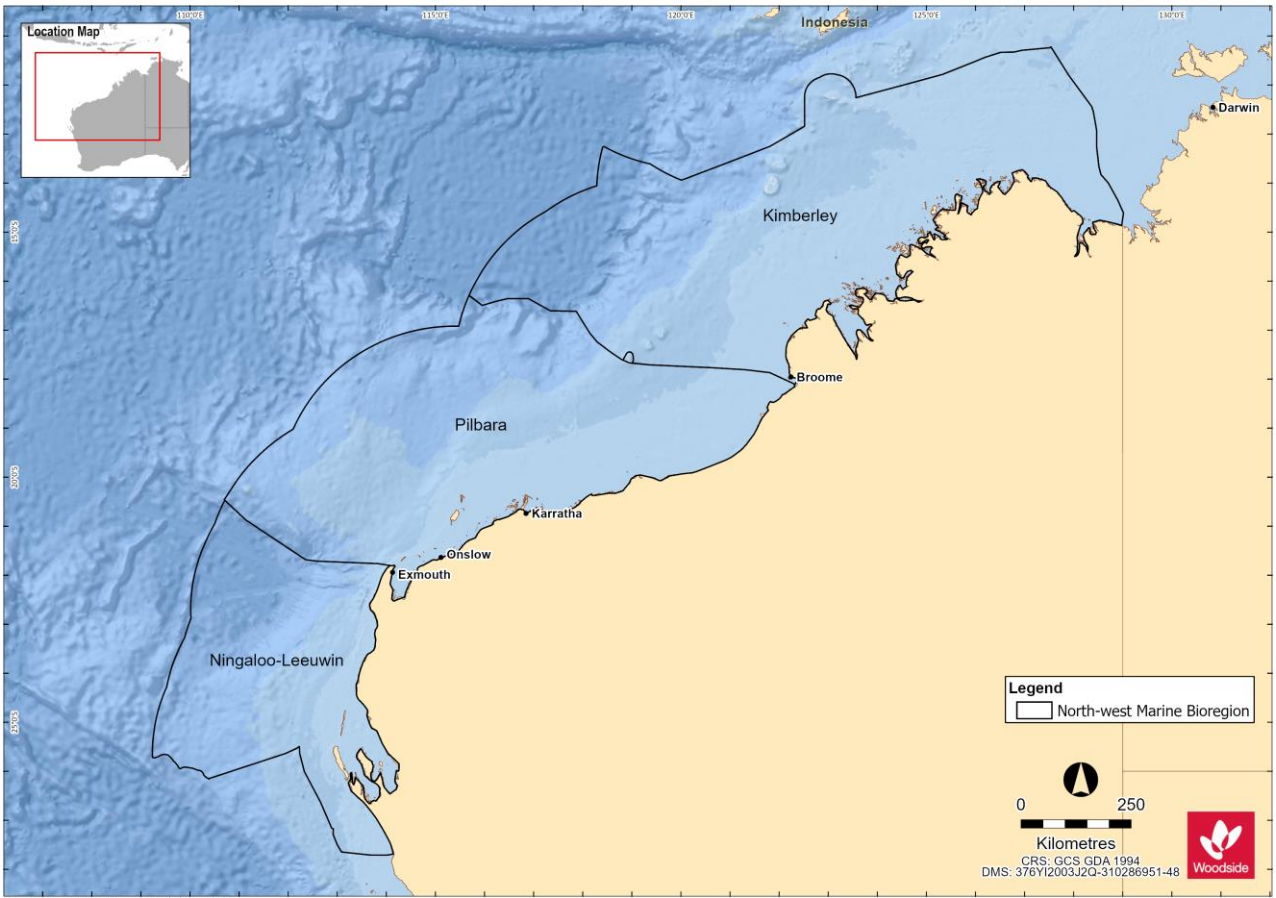

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Figure 2-1. The marine systems of the North-west Marine Region (NWMR)

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Table 2-2. Key characteristics of the Marine Systems of the NWMR

Note: Woodside areas align with the marine systems as described in DEWHA (2007a)

Marine System	Woodside Activity Area	Key Characteristics
Kimberley	Browse	Tropical monsoonal climate Strong influence from Indonesian Throughflow Predominantly tropical Indo-Pacific species Subject to episodic offshore cyclonic activity, rarely crossing the coast Large tidal regimes Freshwater input from terrestrial monsoonal run-off Turbid coastal waters (i.e. light limited systems) Dominated by shelf environments Predominantly hard substrates in inner to mid-shelf environments Includes a number of shelf-edge atolls (i.e. Scott Reef, Rowley Shoals)
Pilbara	North-west Shelf (NWS) / Scarborough	Tropical arid climate Transition between Indonesian Throughflow and Leeuwin Current dominated areas Predominantly tropical species High cyclone activity with frequent crossing of the coast Transitional tidal zone Internal tide activity Large areas of shelf and slope Dry coast with ephemeral freshwater inputs
Ningaloo-Leeuwin	North-west Cape	Subtropical arid climate Leeuwin Current consolidates Transitional tropical/temperate faunal area Higher water clarity in near-shore and offshore environments Narrow shelf and slope Marginal tidal range Seasonal wind forcing more dominant influence on marine environment

2.3 Meteorology and Oceanography

This section describes the general meteorological conditions and oceanography for the NWMR and provides further detail for the three Woodside activity areas. The NWMR is influenced by a complex system of ocean currents that change between seasons and between years, which generally result in its surface waters being warm and nutrient-poor, and of low salinity (DEWHA, 2007a). The mix of bathymetric features, complex topography and oceanography across the whole north-west marine environment has created and supports a globally important marine biodiversity hotspot (Wilson, 2013).

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Table 2-3 NWMR climate and oceanography summary

Receptor	Description
Meteorology	
Seasonal patterns	The NWMR associated land mass of the Australian continent is characterised as a hot and humid summer climate zone. The broader NWMR experiences variations of a tropical or monsoon climate. In the far north-west (Kimberley), there is a hot summer season from December to March and a milder winter season between April and November. The Pilbara area is described as having a tropical arid climate with high cyclone activity (DEWHA, 2007a). The Pilbara and North-west Cape has a hot summer season from October to April and a milder winter season between May and September with transition periods between the summer and winter regimes.
Air temperature and rainfall	In summer (between September and March), maximum daily temperatures range from 31ºC to 33ºC. During winter (May to July), mean daily temperatures range from 18ºC to 31ºC (BOM[1]), refer to **Figure 2-2a** and **b**. Rainfall in the region typically occurs during the summer, with highest falls observed late in the season. This is often associated with the passage of tropical low-pressure systems and cyclones.
Wind	Wind patterns in north-west WA are dictated by the seasonal movement of atmospheric pressure systems. During summer, high-pressure cells produce prevailing winds from the north-west and south-west, which vary between 10 and 13 ms^{-1}. During winter, high-pressure cells over central Australia produce north-easterly to south-easterly winds with average speeds of between 6 and 8 ms^{-1}. Refer to **Figure 2-3a** and **b**.
Tropical cyclones	The NWS and Pilbara coast (within the NWMR) experiences more cyclonic activity than any other region of the Australian mainland coast (BOM, 2021a). Tropical cyclone activity typically occurs between November and April and is most frequent in the region during December to March (i.e. considered the peak period), with an average of about one cyclone per month (BOM, 2021a). Refer to **Figure 2-4**.
Oceanography	
Ocean temperature	Waters in NWMR are tropical year-round, with sea surface temperature in open shelf waters reaching ~26°C in summer and dropping to ~22°C in winter. Nearshore temperatures (as recorded for the NWS area) fluctuate more widely on an annual basis from ~17°C in winter to ~31°C in summer (Chevron Australia, 2010). Refer to **Figure 2-5a** and **b**.
Currents	The major surface currents influencing north-west WA flow towards the poles and include the Indonesian Throughflow, the Leeuwin Current, the South Equatorial Current, and the Eastern Gyral Current. The Ningaloo Current, the Holloway Current, the Shark Bay Outflow, and the Capes Current are seasonal surface currents in the region. Below these surface currents are several subsurface currents, the most important of which are the Leeuwin Undercurrent and the West Australian Current. These subsurface currents flow towards the equator in the opposite direction to surface currents (DEWHA, 2007a). Refer to **Figure 2-6**. The offshore waters of the NWMR are characterised by surface and subsurface boundary currents that flow along the continental shelf/slope and are enhanced through inflows from the ocean basins and are an important conduit for the poleward heat and mass transport along the west coast (Wijeratne *et al.*, 2018). Local physical oceanography is strongly influenced by the large-scale water movements of the Indonesian Throughflow (Liu *et al*. 2015; Sutton *et al*. 2019). Typically, a warm and well-mixed oligotrophic surface layer and a cooler and more nutrient rich, deeper water layer (Menezes *et al*. 2013).
Waves	Sea surface waves within the NWMR, generally reflect the direction of the synoptic winds and flow predominately from the south-west in the summer and east in winter (Pearce *et al.*, 2003). The NWS within the NWMR is a known area of internal wave generation. Both internal tides and internal waves are thought to be more prevalent during summer months due to the increased stratification of the water column (DEWHA, 2007a). Along the continental slope of the NWMR, strong internal waves and interaction between semi-diurnal tidal currents and seabed topographic features facilitates upwelling events and localised productivity events (Holloway, 2001).
Tides	Tides on the NWS (NWMR) increase as the water moves from deep towards the shallower coast. The highest offshore tides are experienced at the border of the Browse and Canning basins. The smallest tides are experienced at the Exmouth Plateau, near the coast. Tides of NWS (NWMR) are predominantly semi-diurnal (two highs and two lows each day), but with increasing importance of the diurnal (once per day) inequality at the southern and northern extremities of the NWS.

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[1] http://www.bom.gov.au/jsp/ncc/climate_averages/temperature/index.jsp, accessed 21 January 2021.

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Receptor	Description
	The tide range—represented by the Mean Spring Range (MSR)—increases northwards along the coast from 1.4 m at North-west Cape (Point Murat) to 7.7 m at Broome, before decreasing again (apart from local amplification in King Sound and Collier Bay) to about 5 m off Cape Londonderry. The MSR then increases again through Joseph Bonaparte Gulf and on up 5.5 m at Darwin (RPS, 2016).

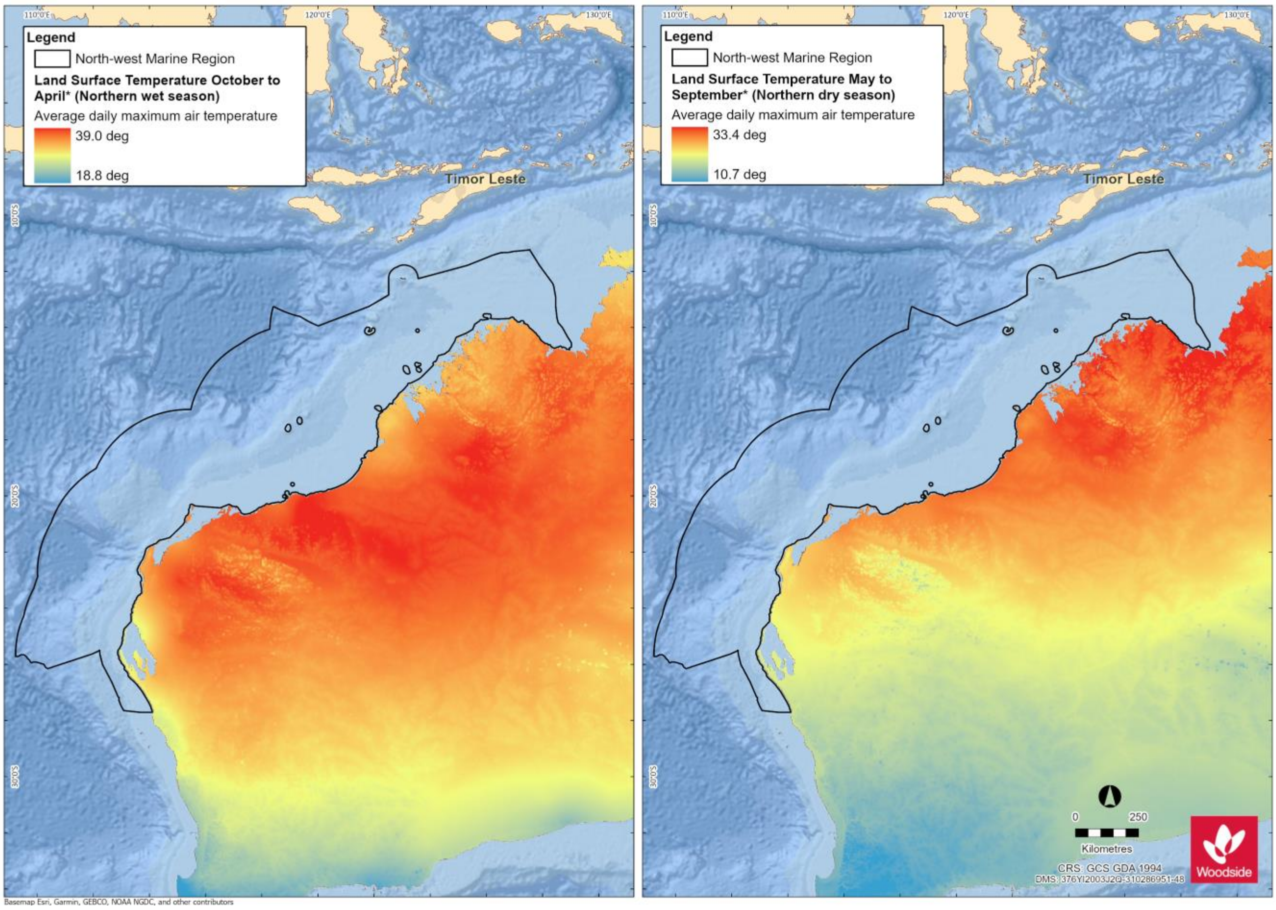

Figure 2-2. Average daily maximum air temperature for land surface adjacent to NWMR: (a) summer (northern wet season) and (b) winter (northern dry season)

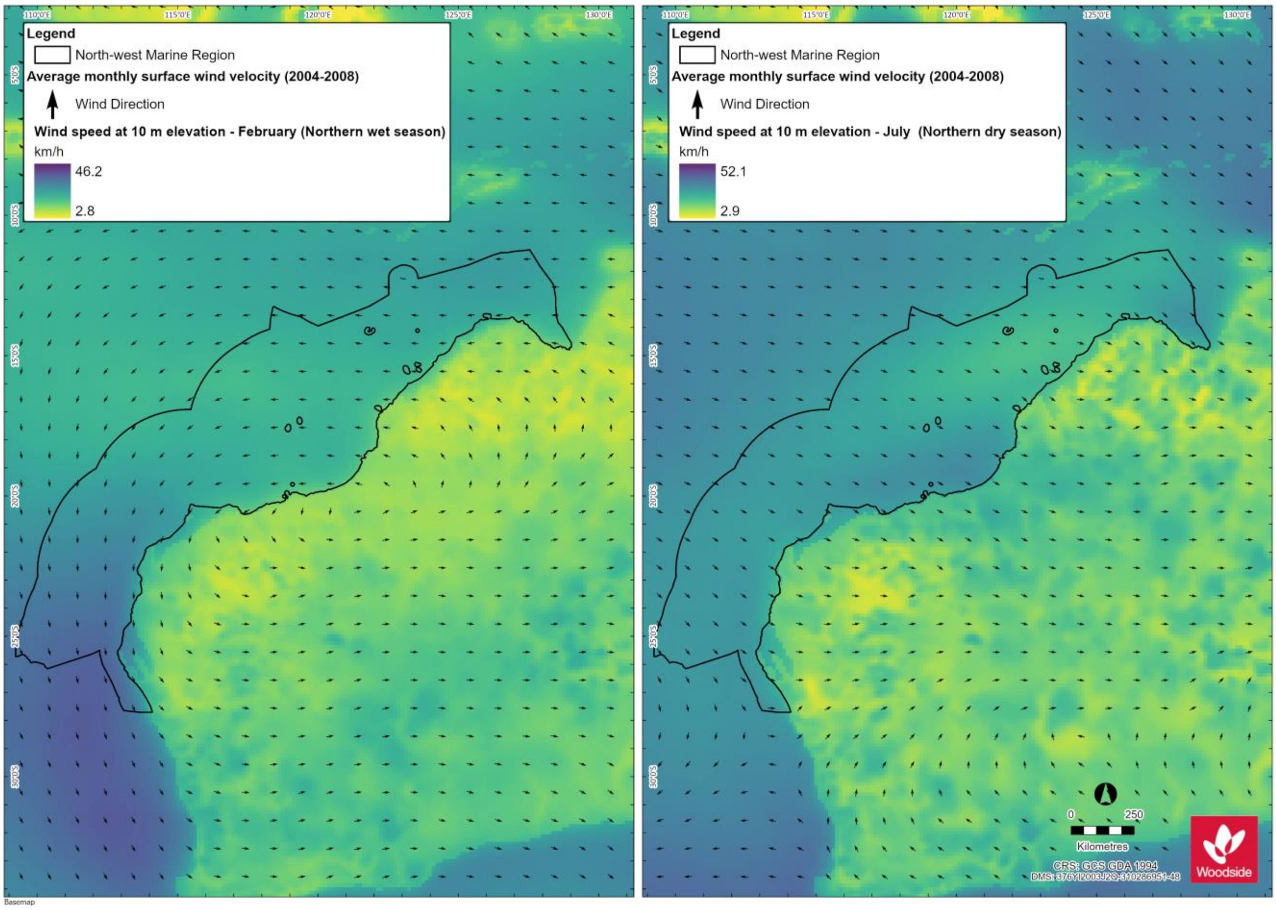

Figure 2-3. Average monthly surface wind direction and velocity for NWMR: (a) summer (February, northern wet season) and (b) winter (July, northern dry season)

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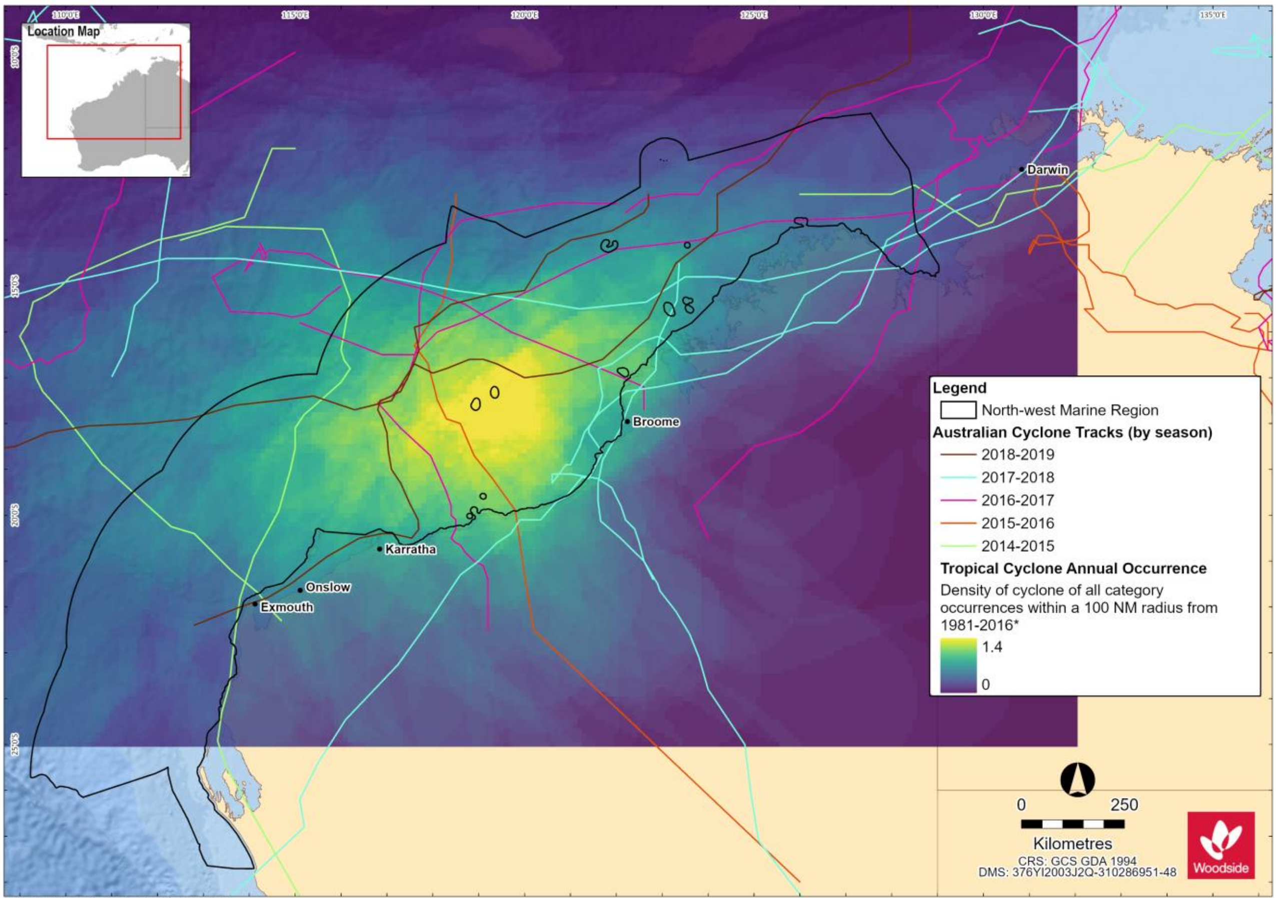

Basemap Esri, Garmin, GEBCO, NOAA NGDC, and other contributors

Figure 2-4. Tropical cyclone annual occurrence and cyclone tracks for NWMR

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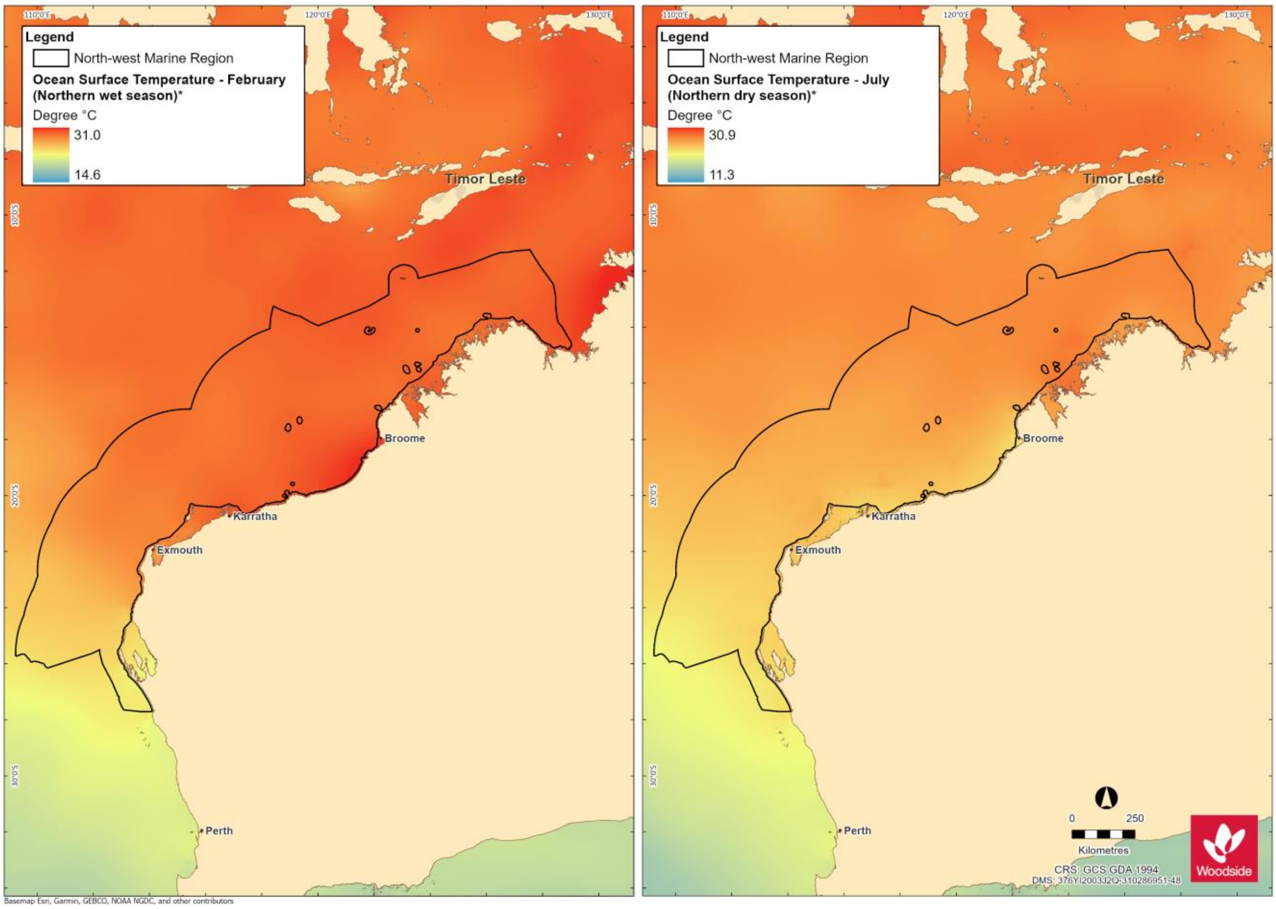

Figure 2-5. Ocean surface temperature for NWMR: (a) summer (February, northern wet season) and (b) winter (July, northern dry season)

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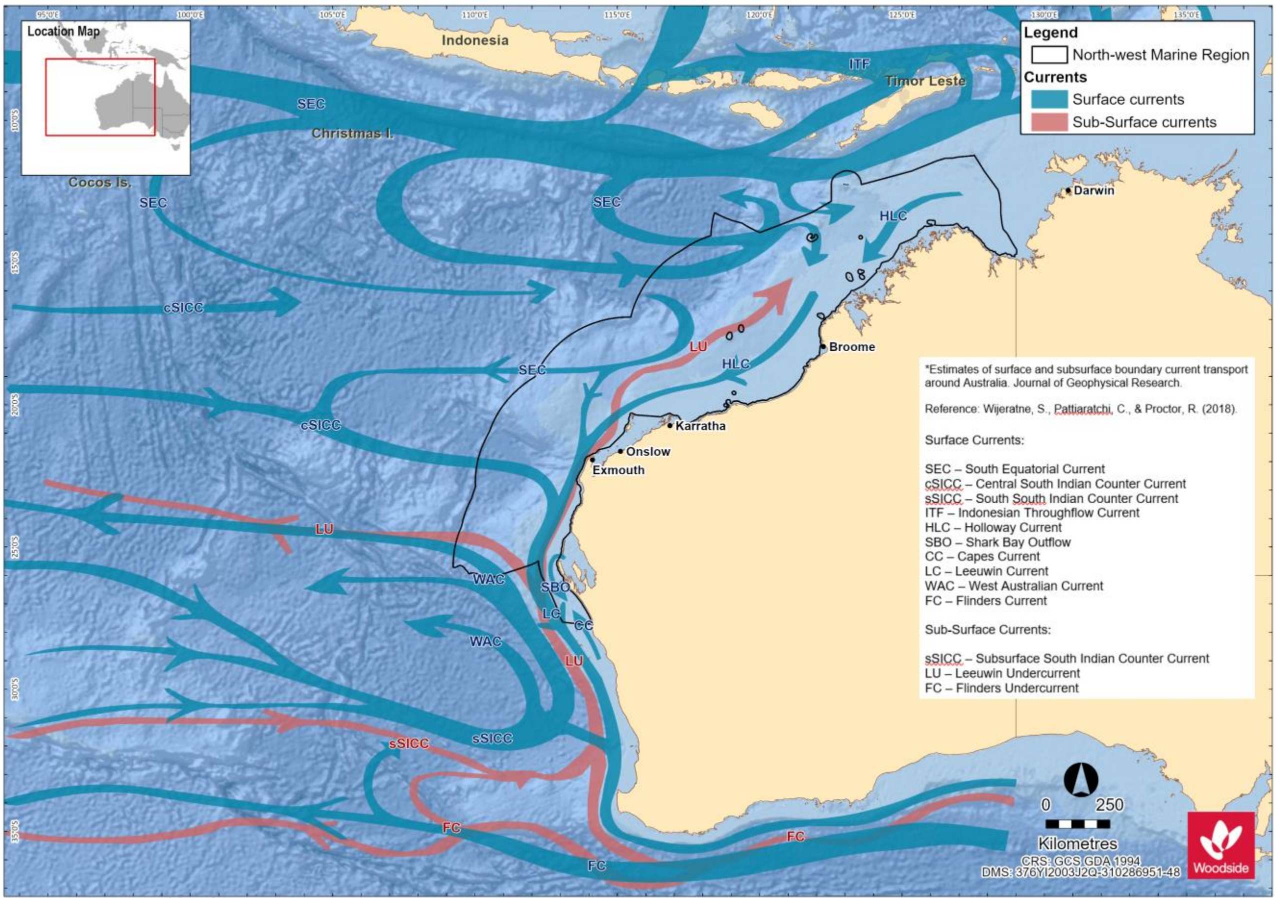

*Estimates of surface and subsurface boundary current transport around Australia. Journal of Geophysical Research.

Reference: Wijeratne, S., Pattiaratchi, C., & Proctor, R. (2018).

Surface Currents:

SEC – South Equatorial Current
cSICC – Central South Indian Counter Current
sSICC – South South Indian Counter Current
ITF – Indonesian Throughflow Current
HLC – Holloway Current
SBO – Shark Bay Outflow
CC – Capes Current
LC – Leeuwin Current
WAC – West Australian Current
FC – Flinders Current

Sub-Surface Currents:

sSICC – Subsurface South Indian Counter Current
LU – Leeuwin Undercurrent
FC – Flinders Undercurrent

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Figure 2-6. Ocean surface and sub-surface currents of the NWMR and wider region

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2.3.1 Browse

Table 2-4 Summary meteorology and oceanography for Browse (refer to Appendix B for supporting metocean figures)

Receptor	Description
Meteorology	
Seasonal patterns	The Browse area overlapping the Kimberley marine system experiences tropical monsoon climate with two distinct seasons: the wet season from December to March and dry season from April to November.
Air temperature	The mean annual air temperature recorded at Troughton Island between 2010 and 2020 ranged from 30.1ºC in 2011 to 32.6ºC in 2016 and highest mean monthly air temperatures were recorded for the months of November and December (BOM, 2021b).
Rainfall	Rainfall recorded from Troughton Island in the Browse basin ranged from barely detectable (<1 mm) mean monthly level to >100 mm in December to March, with the highest rainfall recorded for January. Reflecting the wet monsoon season of the Kimberley marine system (BOM, 2021c).
Wind	The dry season experiences high pressure systems that bring east to south-easterly winds with average wind speeds during the season of approximately 16.6 km/hr and maximum wind gusts of 65 km/hr. In contrast the wet season brings predominately westerly winds with average wind speeds approximately 17 km/hr and maximum gusts exceeding 100 km/hr (generally associated with tropical cyclones (MetOcean Engineers, 2005).
Oceanography	
Currents	Surface currents exhibit seasonal directionality, with flow to the south-west during March to June and more variable outside this period (Woodside, 2019). This is consistent with the stronger Leeuwin Current flow during winter months, with more variable currents driven by local wind stress during periods of weaker Leeuwin Current flow.

2.3.2 North West Shelf / Scarborough

Table 2-5 Summary meteorology and oceanography for the North West Shelf and Scarborough (refer to Appendix B for supporting metocean figures)

Receptor	Description
Meteorology	
Seasonal patterns	The NWS and Scarborough areas experience the monsoonal climate of the wider NWMR with a distinct wet and dry seasonal regime and transitions periods between seasons.
Air temperature	Air temperatures as measured at the North Rankin A platform on NWS ranged from a maximum average of 39.5ºC in summer to a minimum average temperature of 15.6ºC in winter (Woodside, 2012).
Rainfall	Rainfall patterns annually reveal the wet season with highest rainfalls during the late summer, often associated with the passage of tropical low-pressure systems and cyclones. Rainfall in the dry season is typically extremely low. (Pearce *et al.* 2003).
Wind	Winds are typically from the southwest during the wet season (summer) and tending from the south-east during the dry season (winter). The summer south-westerly winds are driven by high pressure cells that pass from west to east over the Australian continent. During the winter period, the relative position of the high-pressure cells shifts further north, leading to prevailing south-easterly winds from the mainland (Pearce *et al.* 2003).
Oceanography	
Currents	The large-scale ocean currents of the NWMR, primarily the Indonesian Throughflow and Leeuwin Current (and Holloway Current), are the primary influence on the NWS and Scarborough areas. The ITF and Leeuwin Current are strongest during the late summer and winter and flow reversals to the north-east, typically short-lived and weak, when there are strong south-westerly winds can generate localised upwelling on the shelf edge (Holloway and Nye, 1985; James *et al.* 2004 and Condie *et al.* 2006).

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2.3.3 North-west Cape

Table 2-6 Summary meteorology and oceanography for the North-west Cape (refer to Appendix B for supporting metocean figures)

Receptor	Description
Meteorology	
Seasonal patterns	The climate of the NWMR is dry tropical exhibiting a hot summer season and a mild winter season. There are often distinct transition periods between the summer and winter regimes, characterised by periods of relatively low winds.
Air temperature	Air temperatures in the North-west Cape area range from high summer temperatures (maximum average of 37.5ºC) and mild winter temperatures (minimum average of 12.2ºC).
Rainfall	Rainfall typically occurs during the summer, with highest rainfall during later summer and autumn, often associated with the passage of tropical low-pressure systems and cyclones. Rainfall is typically low in winter.
Wind	Winds vary seasonally, generally from the south-west quadrant during summer months and the south, south-east quadrant during the autumn and winter months. The summer south-westerly winds are driven by high pressure cells that pass from west to east over the Australian continent. Winds typically weaken and are more variable during the transitional period between the summer and winter seasons, generally between April to August.
Oceanography	
Currents	Surface currents exhibit seasonal directionality, with flow to the south-west during March to June and more variable outside this period (Woodside, 2016). This is consistent with the stronger Leeuwin Current flow during winter months, with more variable currents driven by local wind stress during periods of weaker Leeuwin Current flow.

2.4 Physical Environment of NWMR

Based on the Integrated Marine and Coastal Regionalisation of Australia (IMCRA) Version 4.0, there are eight provincial bioregions that occur within the NWMR, which are based on patterns of demersal fish diversity, benthic habitat and oceanographic data (Commonwealth of Australia, 2006), **Figure 2-7**. Of the eight provincial bioregions that occur within the NWMR, these include four offshore (~65% of total NWMR area) and four shelf (~35% of total NWMR area) bioregions (Baker *et al.,* 2008).

The NWMR is a tropical carbonate margin that comprises an extensive area of shelf, slope and abyssal plain/deep ocean floor, as well as complex areas of bathymetry such as plateau, terraces and major canyons (Harris *et al.*, 2005). A series of reefs are located on the outer shelf/slope of the NWMR, including Ashmore, Cartier, Scott and Seringapatam reefs (Baker *et al*., 2008). The distribution of seafloor geomorphic features has been systematically mapped over much of the Australian margin and adjacent seafloor. The mapped area can be divided into 10 geomorphic regions, of which the NWMR overlays two; the Western Margin and Northern Margin (Harris *et al.*, 2005). Most of the region consists of either continental slope (61%) or continental shelf (28%) (DEWHA, 2007a) with more than 40% of the NWMR having a water depth less than 200 m. The shallow shelf is contrasted by features such as the Cuvier and Argo abyssal plains, which reach depths more than five kilometres. A unique feature of the region is the significant narrowing of the continental shelf around North-west Cape (approximately 7 km wide) from the broad continental shelf in the north of the region (approximately 400 km wide at Joseph Bonaparte Gulf) (DEWHA, 2007a), **Figure 2-8.**

The geological history of the region, as well as its geomorphology and oceanography, has influenced the composition and distribution of sediments (DEWHA, 2007a). The sedimentology of the NWMR is dominated by marine carbonates, which show a broad zoning and fining with water depth. Main trends of the NWMR sediments include a tropical carbonate shelf that is dominated by sand and gravel, an outer shelf/slope zone that is dominated by mud and a relatively homogenous rise and abyssal plain/deep ocean floor that is dominated by non-carbonate mud (Baker *et al.,* 2008), **Figure 2-9**.

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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 events such as cyclones. Further offshore, on the mid to outer shelf and on the slope itself, sediment movement is primarily influenced by ocean currents and internal tides (DEWHA, 2007a).

This variation in bathymetry and interactions with oceanographic processes provides a diversity of habitats to marine fauna and flora within the NWMR.

2.5 Air quality

The ambient air quality of all three marine regions is largely unpolluted due to the extent of the open ocean area, the activities currently carried out in each and the relative remoteness of each region.

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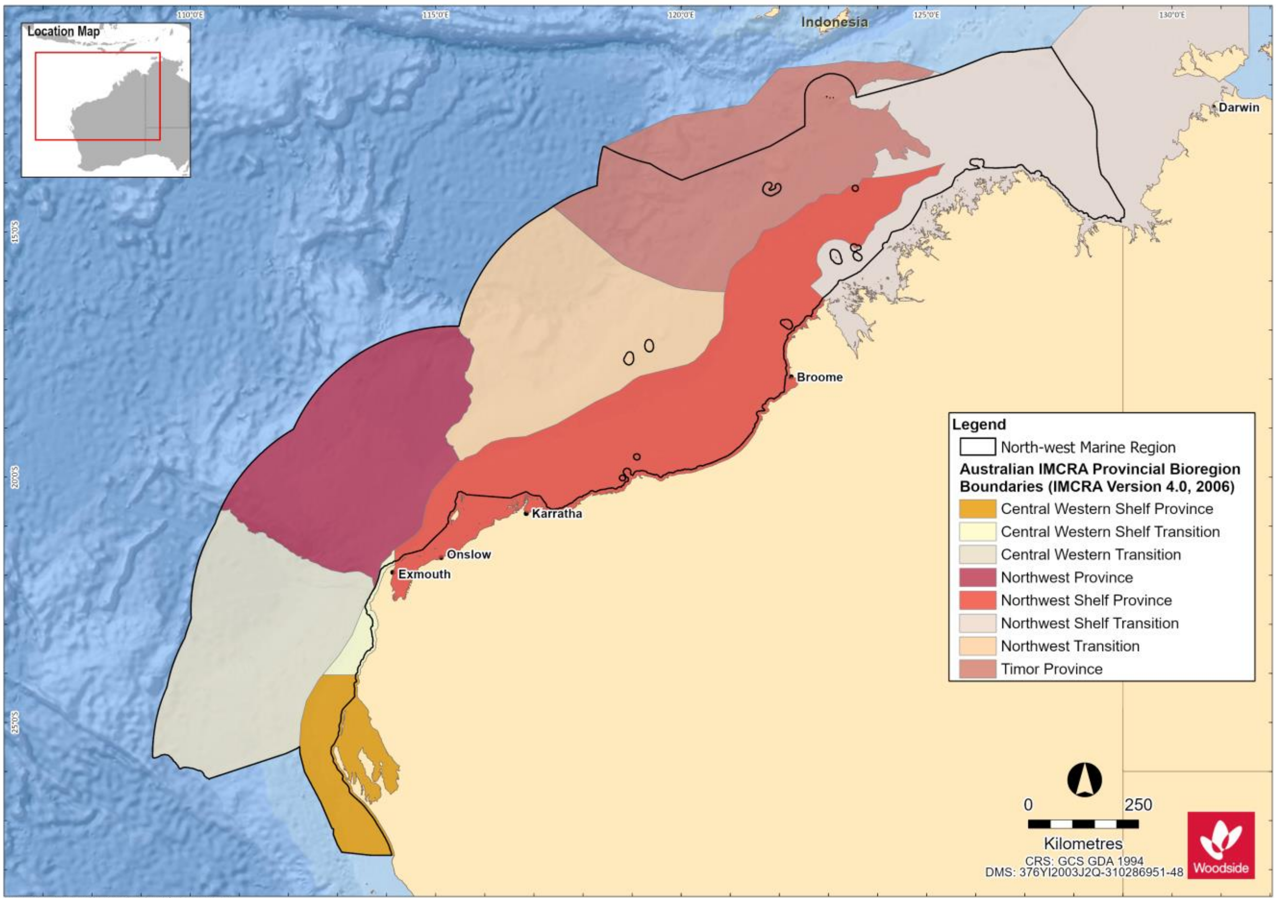

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Figure 2-7. The eight provincial bioregions of the NWMR (Commonwealth of Australia, 2006)

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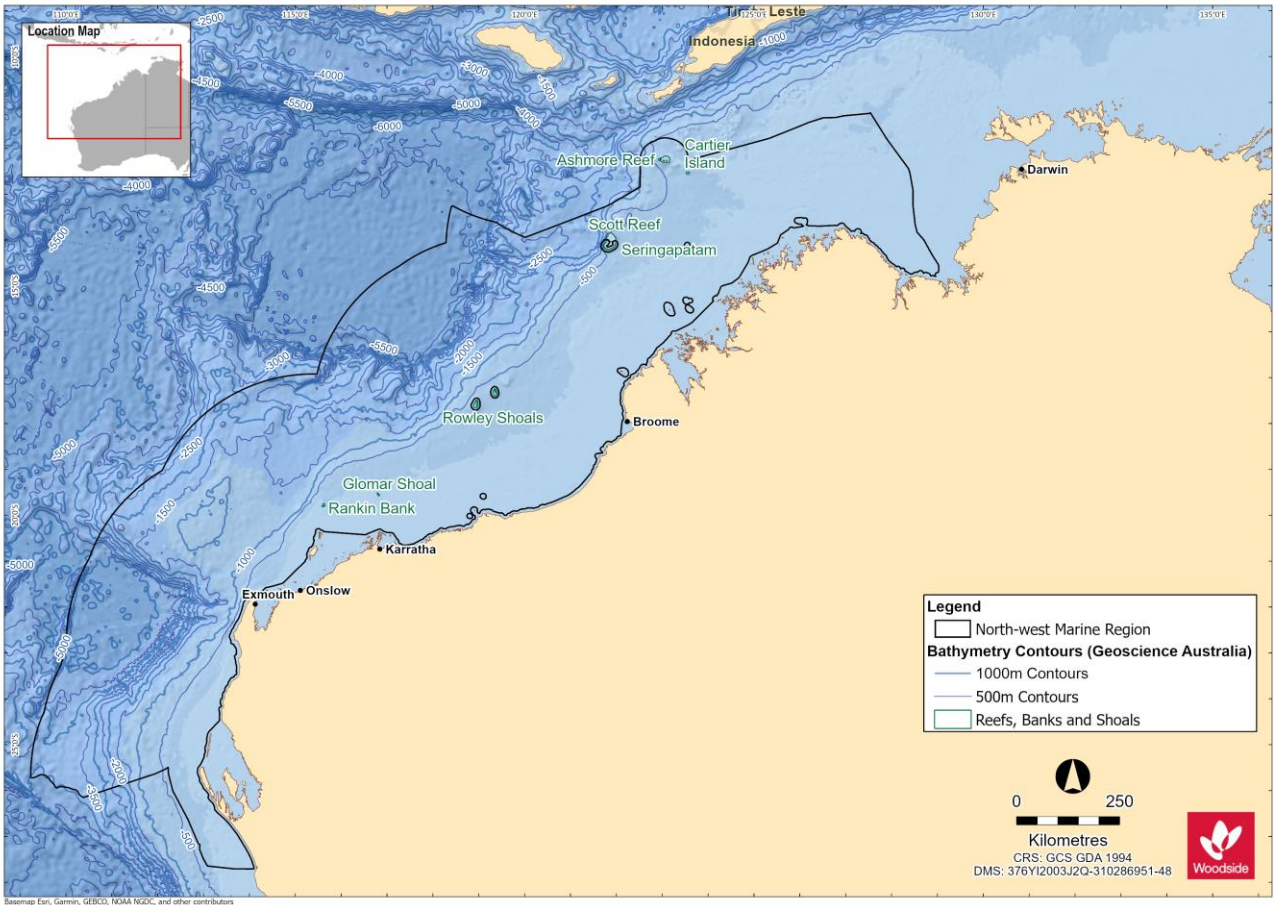

Figure 2-8. Bathymetry of the NWMR

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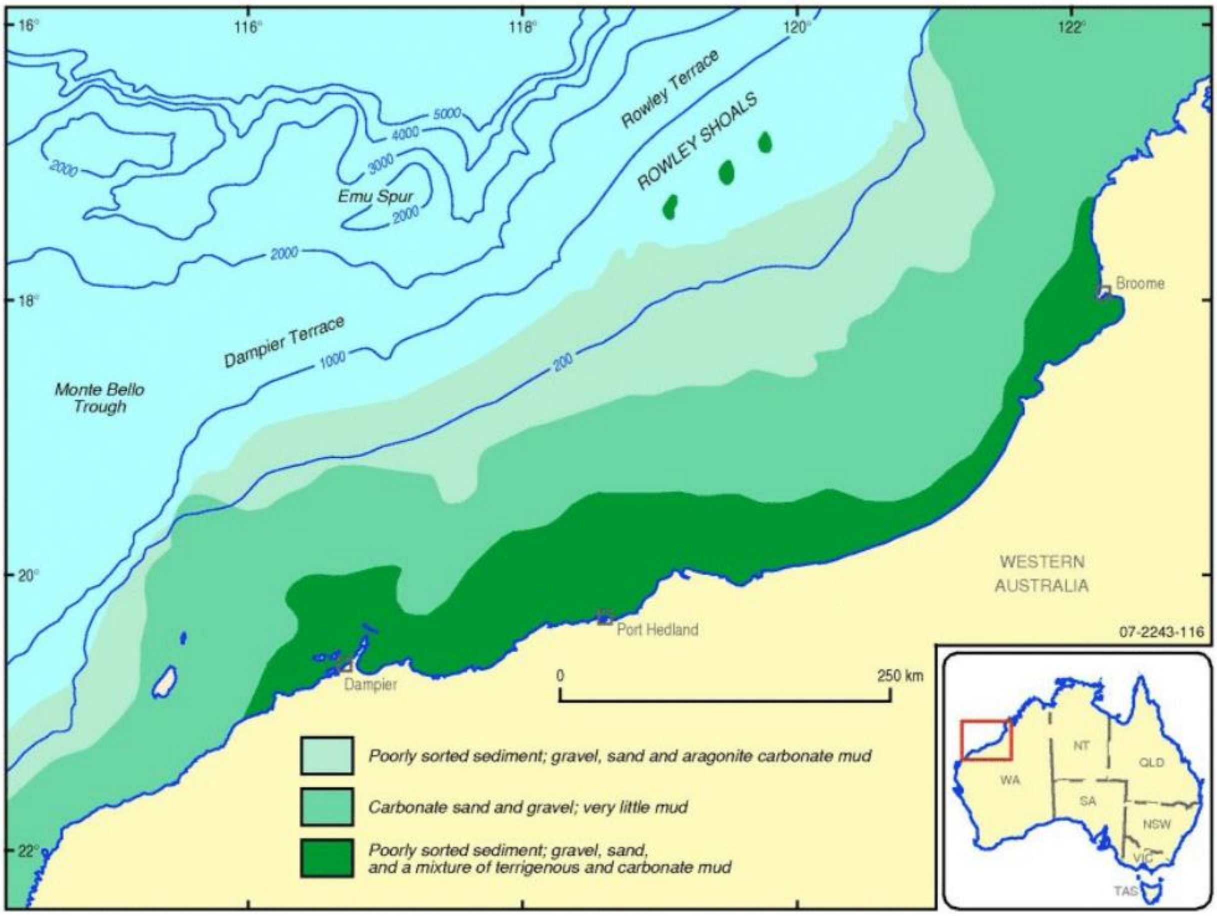

Figure 2-9. Overview of the seabed sediments of the NWMR (Baker *et al*., 2008)

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3. MATTERS OF NATIONAL ENVIRONMENTAL SIGNIFICANCE (EPBC ACT)

3.1 Summary of Matters of National Environmental Significance (MNES)

This section summarises the matters of national environmental significance (MNES) reported for the three bioregions; NWMR **(Table 3-1),** SWMR (**Table 3-2**) and NMR (**Table 3-3**), based on the Protected Matters search reports (**Appendix A**).

Additional information on these MNES are provided in subsequent sections (referenced below).

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Table 3-1 Summary of MNES identified by the EPBC Act Protected Matters Search Tool (PMST) as potentially occurring within the NWMR

MNES	Number	Description	Section of this Document
World Heritage Properties	2	Shark Bay The Ningaloo Coast	**Section 10**
National Heritage Places	5	Shark Bay The Ningaloo Coast The West Kimberley The Dampier Archipelago (including Burrup Peninsula) Dirk Hartog Landing Site 1616	**Section 10**
Wetlands of International Importance (Ramsar)	3	Ashmore Reef National Nature Reserve Eighty Mile Beach Roebuck Bay[1]	**Section 10**
Commonwealth Marine Area	2	EEZ and Territorial Sea Key Ecological Features (KEFs) Australian Marine Parks (AMPs) Australian Whale Sanctuary Extended Continental Shelf	**Section 9** **Section 10**
Listed Threatened Ecological Communities	1	Monsoon vine thickets on the coastal sand dunes of Dampier Peninsula	Terrestrial community and not considered further
Listed Threatened Species	70	Refer NWMR PMST report (**Appendix A**)	**Section 5 – Section 8**
Listed Migratory Species	84	Refer NWMR PMST report (**Appendix A**)	**Section 5 – Section 8**

[1] *Roebuck Bay is a designated Wetland of International Importance (Ramsar site), which was not included in the PMST Report (**Appendix A**).*

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Table 3-2 Summary of MNES identified by the EPBC Act Protected Matters Search Tool (PMST) as potentially occurring within the SWMR

MNES	Number	Description	Section of this Document
World Heritage Properties	0	N/A	N/A
National Heritage Places	3	Cheetup Rock Shelter Batavia Shipwreck Site and Survivor Camps Area 1629 – Houtman Abrolhos HMAS Sydney II and HSK Kormoran Shipwreck Sites	**Section 10**
Wetlands of International Importance (Ramsar)	4	Becher Point Wetlands Forrestdale and Thomsons Lakes Peel-Yalgorup System Vasse-Wonnerup System	**Section 10**
Commonwealth Marine Area	2	EEZ and Territorial Sea KEFs AMPs Australian Whale Sanctuary Extended Continental Shelf	**Section 9** **Section 10**
Listed Threatened Ecological Communities	3	Banksia Woodlands of the Swan Coastal Plain ecological community Proteaceae Dominated Kwongkan Shrublands of the Southeast Coastal Floristic Province of Western Australia Tuart (*Eucalyptus gomphocephala*) Woodlands and Forests of the Swan Coastal Plain ecological community	Terrestrial communities and not considered further
Listed Threatened Species	65	Refer SWMR PMST report (**Appendix A**)	N/A
Listed Migratory Species	67	Refer SWMR PMST report (**Appendix A**)	N/A

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Table 3-3 Summary of MNES identified by the EPBC Act Protected Matters Search Tool (PMST) as potentially occurring within the NMR

MNES	Number	Description	Section of this Document
World Heritage Properties	0	N/A	N/A
National Heritage Places	0	N/A	N/A
Wetlands of International Importance (Ramsar)	0	N/A	N/A
Commonwealth Marine Area	2	EEZ and Territorial Sea KEFs AMPs Australian Whale Sanctuary Extended Continental Shelf	**Section 9** **Section 10**
Listed Threatened Ecological Communities	0	N/A	N/A
Listed Threatened Species	33	Refer NMR PMST report (**Appendix A**)	N/A
Listed Migratory Species	70	Refer NMR PMST report (**Appendix A**)	N/A

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3.2 Part 13 Statutory Instruments for EPBC Act Listed Threatened and Migratory Species in the NWMR, SWMR and NMR

A screening process was conducted to identify which EPBC Act listed threatened and migratory species, and associated Part 13 statutory instruments, are relevant in the context of the assessment of impacts and risks associated with petroleum activities in each of the Woodside activity areas, using the following criteria:

- overlap between the Woodside activity areas with habitat critical for the survival of marine turtles, and with BIAs (overlapping the marine environment) for any listed threatened species as reported in the PMST searches;
- published literature, unpublished reports and/or credible anecdotal information (e.g. feedback from stakeholders) indicating species presence/occurrence within the Woodside activity areas;
- temporal overlap between the likely timing of petroleum activities and peak periods for key behaviours (e.g. breeding, nesting, calving, resting, foraging, migration); and
- environmental aspects associated with petroleum activities have been identified as a key threat to a species in a Part 13 statutory instrument (e.g. anthropogenic noise, light emissions, marine debris).

Relevant EPBC Act threatened and migratory species and their Part 13 statutory instruments are listed in **Table 3-4**. For the full list of EPBCA Act listed species for each marine bioregion refer to the PMST reports (**Appendix A**).

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Table 3-4 Summary of MNES identified by the EPBC Act Protected Matters Search Tool (PMST) to be considered for impact or risk evaluation for Woodside operations

Species	EPBC Act Part 13 Statutory Instrument
All vertebrate marine fauna	Threat Abatement Plan for the impacts of marine debris on vertebrate marine life (Commonwealth of Australia, 2018)
Marine Mammals	
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)
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, 2012d)
Sei whale	Conservation Advice *Balaenoptera borealis* sei whale (Threatened Species Scientific Committee, 2015a)
Humpback whale	Conservation Advice *Megaptera novaeangliae* humpback whale (Threatened Species Scientific Committee, 2015b)
Fin whale	Conservation Advice *Balaenoptera physalus* fin whale (Threatened Species Scientific Committee, 2015c)
Australian sea lion	Recovery Plan for the Australian Sea Lion (*Neophoca cinerea*) 2013 (DSEWPAC, 2013a) (due to expire in October 2023) Conservation Advice *Neophoca cinerea* Australian Sea Lion (Threatened Species Scientific Committee, 2020a) (in effect under the EPBC Act from 23-Dec-2020)
Marine Reptiles	
All marine turtle species (loggerhead, green, leatherback, hawksbill, flatback, olive ridley)	Recovery Plan for Marine Turtles in Australia 2017-2027 (Commonwealth of Australia, 2017)
Short-nosed sea snake	Approved Conservation Advice for *Aipysurus apraefrontalis* (Short-nosed Sea Snake) (DSEWPAC, 2011a)
Leaf-scaled sea snake	Approved Conservation Advice for *Aipysurus foliosquama* (Leaf-scaled Sea Snake) (DSEWPAC, 2011b)
Fishes, Sharks, Rays and Sawfishes	
Grey nurse shark (west coast population)	Recovery Plan for the Grey Nurse Shark (*Carcharias taurus*) 2014 (DOE, 2014)
White shark	Recovery Plan for the White Shark (*Carcharodon carcharias*) 2013 (DSEWPAC, 2013b)
Whale shark	Conservation Advice *Rhincodon typus* whale shark (Threatened Species Scientific Committee, 2015d)
All sawfishes (largetooth, green, dwarf, speartooth, narrow)	Sawfish and River Sharks Multispecies Recovery Plan (Commonwealth of Australia, 2015b)

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Species	EPBC Act Part 13 Statutory Instrument
Seabirds	
Migratory seabird species	Draft Wildlife Conservation Plan for Migratory Seabirds (Commonwealth of Australia, 2019)
Southern giant petrel	National recovery plan for threatened albatrosses and giant petrels 2011–2016 (DSEWPAC, 2011c)
Indian yellow-nosed albatross	National recovery plan for threatened albatrosses and giant petrels 2011–2016 (DSEWPAC, 2011c)
Abbott's booby	Conservation Advice for the Abbott's booby - *Papasula abbotti* (Threatened Species Scientific Committee, 2020b)
Australian fairy tern	Approved Conservation Advice for *Sterna nereis nereis* (Fairy Tern) (DSEWPAC, 2011d)
Australian lesser noddy	Conservation Advice *Anous tenuirostris melanops* Australian lesser noddy (Threatened Species Scientific Committee, 2015e)
Soft-plumaged petrel	Conservation Advice *Pterodroma mollis* soft-plumaged petrel (Threatened Species Scientific Committee, 2015f)
Shorebirds	
Migratory shorebird species	Wildlife Conservation Plan for Migratory Shorebirds (Commonwealth of Australia, 2015c)
Eastern curlew, far eastern curlew	Conservation Advice *Numenius madagascariensis* eastern curlew (DOE, 2015a)
Curlew sandpiper	Conservation Advice *Calidris ferruginea* curlew sandpiper (DOE, 2015b)
Great knot	Conservation Advice *Calidris tenuirostris* Great knot (Threatened Species Scientific Committee, 2016a)
Red knot, knot	Conservation Advice *Calidris canutus* Red knot (Threatened Species Scientific Committee, 2016b)
Bar-tailed godwit (*menzbieri*)	Conservation Advice *Limosa lapponica menzbieri* Bar-tailed godwit (northern Siberia) (Threatened Species Scientific Committee, 2016c)
Greater sand plover	Conservation Advice *Charadrius leschenaultii* Greater sand plover (Threatened Species Scientific Committee, 2016d)
Lesser sand plover	Conservation Advice *Charadrius mongolus* Lesser sand plover (Threatened Species Scientific Committee, 2016e)

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4. HABITAT AND BIOLOGICAL COMMUNITIES

4.1 Regional context

The NWMR habitats range from nearshore benthic primary producer habitats such as seagrass beds, coral communities and mangrove forests, to offshore soft sediment seabed habitats and submerged and emergent reef systems. These habitats support biological communities that range from low density sessile and mobile benthos, such as sponges, molluscs and echinoids (with noted areas of sponge hotspot diversity) in offshore soft sediment habitat (DSEWPAC, 2012a) to complex, diverse, remote coral reef systems.

Benthic primary producer habitats, such as seagrass beds, coral communities and mangrove forests within the SWMR, are described as a mixture of tropical and temperate species, due to the seasonal influences of the tropical waters carried south by the Leeuwin Current and the temperate waters carried north by the Capes Current (DSEWPAC, 2012b).

The NMR shares similar habitat types to the NWMR. The predominant habitat of the region includes soft muddy sediments on relatively flat terrain. Other habitat types include seagrasses, reefs, shoals and coastal habitats such as mangroves and coastal wetlands (Rochester *et al.*, 2007).

The summary of key habitats and biological communities provided in the following sub-sections is focused on the primary features of relevance to the activity areas within the NWMR – primarily the offshore habitats of the continental shelf and slope, submerged shoals and banks, and remote oceanic reef systems of recognised conservation value.

4.2 Biological Productivity of NWMR

Primary productivity of the NWMR is generally low and 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. Seasonal weather patterns also influence the delivery of nutrients from deep-water to shallow water. Cyclones and north-westerly winds during the North-west monsoon (approximately November–March) and the strong offshore winds of the South-east monsoon (approximately April–September) facilitate the upwelling and mixing of nutrients from deep-water to shallow water environments (Brewer *et al.*, 2007).

The Indonesian Throughflow (ITF) has an important effect on productivity in the northern areas of the Region. Generally, its deep, warm and low nutrient waters suppress upwelling of deeper comparatively nutrient-rich waters, thereby forcing the highest rates of primary productivity to occur at depths associated with the thermocline. When the ITF is weaker, the thermocline lifts bringing deeper, more nutrient-rich waters into the photic zone and hence resulting in conditions favourable to increased productivity (DEWHA, 2007a). Similarly, the Leeuwin Current has a significant role in determining primary productivity in the southern areas of the NWMR. As with the ITF, the overlying warm oligotrophic waters of the Leeuwin Current suppress upwelling. A subsurface chlorophyll maximum is therefore formed at a depth in the water column where nutrients and light are sufficient for photosynthesis to proceed. Seasonal changes in the strength of the Leeuwin Current influence primary productivity levels and seasonal interactions between the Leeuwin and Ningaloo currents in the south of the NWMR are believed to be particularly important (DEWHA, 2007a).

Internal tides (defined as internal waves generated by the barotropic tide) are a striking characteristic of many parts of the NWMR and are associated with highly stratified water columns. Internal waves (solitons), which can raise cooler, generally more nutrient rich water higher in the water column, are generated between water depths of 400 m and 1000 m where bottom topography results in a significant change in water depth over a relatively short distance. Cyclones are episodic events in the NWMR that contribute to spikes in productivity through enrichment of surface water layers due to enhanced vertical mixing of the water column. Temporary increases in primary productivity as a result of cyclones generally last between one and two weeks, and it is believed that the impacts of

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cyclones are generally limited to waters less than 100 m deep and affect benthic communities more substantially than pelagic systems (DEWHA, 2007a).

Water depth also has a significant overriding influence over productivity in the marine environment, due to its influence on light availability. This is reflected by distinct onshore and offshore assemblages of major pelagic groups of phytoplankton, microzooplankton, mesoplankton and ichthyoplankton. Productivity booms are thought to be triggered by seasonal changes to physical drivers or episodic events, as detailed above, which result in rapid increases in primary production over short periods, followed by extended periods of lower primary production. The trophic systems in the NWMR are able to take advantage of blooms in primary production, enabling nutrients generated to be used by different groups of consumers over long periods (DEWHA, 2007a).

Little detailed information is available about the trophic systems in the NWMR. The utilisation of available nutrients is thought to differ between pelagic and benthic environments, influenced by water depth and vertical migration of some species groups in the water column. In the pelagic system, it is thought that approximately half of the nutrients available are utilised by microzooplankton (e.g. protozoa) with the remainder going to macro/meso-zooplankton (e.g. copepods). As primary and secondary consumers, gelatinous zooplankton (e.g. salps, coelenterates) and jellyfish are thought to play an important role in the food web, contributing a significant proportion of biomass in the marine system during and for periods after booms in primary productivity. Salps are semi-transparent, barrel-shaped marine animals that can reproduce quickly in response to bursts in primary productivity and provide a food source for many pelagic fish species (DEWHA, 2007a).

4.3 Planktonic Communities in the NWMR

The NWMR has two distinct phytoplankton assemblages; a tropical oceanic community in offshore waters and a tropical shelf community confined to the NWS (Hallegraeff, 1995). MODIS (Moderate Resolution Imaging Spectrometer) satellite datasets from the NWMR indicates that chlorophyll (and thus phytoplankton) levels are low in summer months (December to March) and higher in the winter months (Schroeder *et al.*, 2009). Low chlorophyll levels during summer months may be a result of lower plankton productivity during the wet season or lower nutrient inputs from warm surface waters dominant during summer. However, it is likely that much of the primary production is taking place below the surface, where the MODIS imagery does not penetrate (Schroeder *et al.*, 2009). The winter months are relatively cloud free and surface chlorophyll is high throughout most of the region.

Zooplankton and 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 and Gilmour, 2008) and fish larvae abundance (CALM, 2005a) can occur throughout the year. Spatial and temporal patterns in the distribution and abundance of macro-zooplankton on the North-west Shelf are influenced by sporadic climatic and oceanographic events, with large inter-annual changes in assemblages (Wilson *et al.*, 2003). Amphipods, euphausiids, copepods, mysids and cumaceans are among the most common components of the zooplankton in the region (Wilson *et al.*, 2003).

4.3.1 Browse

Phytoplankton within the Browse activity area is expected to reflect the conditions of the NWMR. 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 activity 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 and Gilmour, 2008; Simpson *et al.*, 1993) and fish larvae abundance (CALM, 2005a) can occur throughout the year.

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The influence of the Indonesian Throughflow restricts upwelling across the Kimberley System (approximately equates to the Browse activity area). However, small-scale topographically associated current movements and upwellings are thought to occur, which inject nutrients into specific locations within the system and result in 'productivity hot-spots'. Similarly, internal waves, generated at the shelf break (e.g. west of Browse Island and around submerged cliffs) play a role in making nutrients available in the photic zone. Productivity within shallow nearshore waters is driven primarily by tidal movement and terrestrial runoff whereby nutrients are mixed by tidal action and new inputs of organic matter come from the land.

4.3.2 North-west Shelf / Scarborough

Plankton communities within the NWS / Scarborough activity area are expected to reflect conditions of the NWMR. Within the Pilbara system of the NWMR (approximately equates to the NWS / Scarborough activity area). Internal tides along the NWS and Exmouth Plateau result in the drawing of deeper cooler waters into the photic zone, stirring up nutrients and triggering primary productivity. Broadly the greatest productivity within this sub-system is found around the 200 m isobath associated with the shelf break.

4.3.3 North-west Cape

Waters of the North-west Cape experience a relatively high diversity of phytoplankton groups including diatoms, coccolithophorids and dinoflagellates. During the warmer months blooms of *Trichodesmium* occur in the region, these have been observed particularly on the frontal systems around Point Murat (Heyward *et al*., 2000).

Average Leeuwin Current phytoplankton biomass is characteristic of low productivity oceanic waters like the Indian, Pacific and Atlantic Oceans (Hanson *et al.*, 2005). However, the Canyons linking the Cuvier Abyssal Plain and Cape Range Peninsula KEF are connected to the Commonwealth waters adjacent to Ningaloo Reef, and may also have connections to Exmouth Plateau. The canyons are thought to interact with the Leeuwin Current to produce eddies inside the heads of the canyons, resulting in waters from the Antarctic intermediate water mass being drawn into shallower depths and onto the shelf (Brewer *et al.* 2007). These waters are cooler and richer in nutrients and strong internal tides may also aid upwelling at the canyon heads (Brewer *et al.* 2007). The narrow shelf width (about 10 kilometres) near the canyons facilitates nutrient upwelling and relatively high productivity. This high primary productivity leads to high densities of primary consumers, such as micro and macro-zooplankton, such as amphipods, copepods, mysids, cumaceans, euphausiids (Brewer *et al.*, 2007).

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4.4 Habitats and Biological Communities in the NWMR

4.4.1 Offshore Habitats and Biological communities

The NWMR has a large area of continental shelf and continental slope, with a range of bathymetric features such as canyons, plateaus, terraces, ridges, reefs, banks and shoals. The marine environment in this region is typified by tropical to sub-tropical marine ecosystems with diverse habitats from soft sediments, canyons, remote coral reefs and limestone pavement.

The key habitats and biological communities representative of the broader NWMR are summarised in **Table 4-1**.

The key habitats and biological communities representative of the broader SWMR and NMR are summarised in **Table 4-2** and **Table 4-3**.

4.4.2 Shoreline habitats and biological communities

The NWMR encompasses offshore and coastal waters, islands and mainland shoreline habitats typified by mangroves, tidal flats, saltmarshes, sandy beaches, and smaller areas of rocky shores. Each of these shoreline types has the potential to support different flora and fauna assemblages due to the different physical factors (e.g. waves, tides, light, etc.) influencing the habitat.

The key shoreline habitats representative of the broader NWMR are summarised in **Table 4-1**.

The key shoreline habitats representative of the broader SWMR and NMR are summarised in **Table 4-2** and **Table 4-3**.

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Table 4-1 Habitats and biological communities within the NWMR

Habitat/Community	Browse	NWS / Scarborough	North-west Cape	Reference
Offshore habitats and biological communities				
Soft sediment with infauna	The offshore environment of the NWMR comprises predominately of seabed habitats dominated by soft sediments (sandy and muddy substrata with occasional patches of coarser sediments) and sparse benthic biota. The benthic communities inhabiting the predominantly soft, fine sediments of the offshore habitats are characterised by infauna such as polychaetes, and sessile and mobile epifauna such as crustacea (shrimp, crabs and squat lobsters) and echinoderms (starfish, cucumbers).The density of benthic fauna is typically lower in deep-sea sediment habitats (greater than 200 m) than in shallower coastal sediment habitats, but the diversity of communities may be similar.			
Soft sediment with hard substrate outcropping	A unique seafloor feature combining both soft sediment and hard substrates, including outcrops, terraces, continental slope, and escarpments. This habitat is found in offshore areas of the NWMR, often associated with key ecological features such as the Ancient coastline at 125 m depth contour KEF.			**Section 9**
	Ancient Coastline at 125 m Depth Contour KEF Continental Slope Demersal Fish Communities KEF	Ancient Coastline at 125 m Depth Contour KEF Continental Slope Demersal Fish Communities KEF	Ancient Coastline at 125 m Depth Contour KEF Continental Slope Demersal Fish Communities KEF	**Section 9**
Coral Reef	Coral reef habitats within the NWMR have a high species diversity that includes corals, and associated reef species such as fishes, crustaceans, invertebrates, and algae. Coral reef habitats of the offshore environment of the NWMR include remote oceanic reef systems, large platform reefs, submerged banks and shoals.			
	Browse Island Scott Reef Seringapatam Reef Ashmore Reef Cartier Island Hibernia Reef	Rowley Shoals (including Mermaid Reef, Clerke Reef, Imperieuse Reef) Glomar Shoal Rankin Bank	-	**Section 10**
Seagrass and Macroalgae communities	Seagrass beds and benthic macroalgae reefs are a main food source for many marine species and also provide key habitats and nursery grounds (Heck Jr. *et al.*, 2003; Wilson *et al.*, 2010). In the northern half of Western Australia, these habitats are restricted to sheltered and shallow waters, including around offshore reef systems, due to large tidal movement, high turbidity, large seasonal freshwater run-off and cyclones.			
	Scott Reef Seringapatam Reef Ashmore Reef	Rowley Shoals (including; Mermaid Reef, Clerke Reef, Imperieuse Reef)		**Section 10**
Filter Feeders/ heterotrophic	Filter feeder epifauna such as sponges, ascidians, soft corals and gorgonians are animals that feed by actively filtering suspended matter and food particles from water, by passing the water over specialised filtration structures (DEWHA, 2008). Filter feeders generally live in areas that have strong currents and hard substratum, often associated with deeper environments of the shoals and banks in the offshore NWMR.			
	Lower outer reef slopes of the oceanic reef	Glomar Shoal Rankin Bank	Cape Range canyon system	**Section 10**

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Habitat/Community	Browse	NWS / Scarborough	North-west Cape	Reference
	systems such as Scott Reef	Ancient coastline at 125 m depth contour KEF		
Sandy Beaches	Sandy beaches are dynamic environments, naturally fluctuating in response to external forcing factors (e.g. waves, currents, etc). Sandy beaches vary in length, width and gradient, and in sediment type, composition, and grain size throughout the NWMR, being found around islands and reefs in the offshore areas of the region.			
	Browse Island Scott Reef (Sandy Islet) Ashmore Reef Cartier Island	Montebello Islands Lowendal Islands Barrow Island	Muiron Islands	**Section 10**
Nearshore/coastal habitats and biological communities				
Coral Reef	Coral reef habitats typically found in nearshore regions of the NWMR include the fringing reefs around coastal islands and the mainland shore.			
	Kimberley East Holothuria and Long reefs Bonaparte and Buccaneer Archipelagos Montgomery Reef Adele complex (Beagle, Mavis, Albert, Churchill reefs, Adele Island)	Dampier Archipelago Montebello, Lowendal and Barrow Island Groups	Ningaloo Reef Exmouth Gulf Shark Bay	**Section 10**
Seagrass and Macroalgae communities	Seagrass beds and benthic macroalgae reefs are a main food source for many marine species and also provide key habitats and nursery grounds (Heck Jr. *et al.*, 2003; Wilson *et al.*, 2010). In the nearshore areas of the NWMR, these habitats are restricted to sheltered and shallow waters due to large tidal movement, high turbidity, large seasonal freshwater run-off and cyclones. These areas include in bays and sounds and around reef and island groups.			
	King Sound	Roebuck Bay Dampier Archipelago Montebello, Lowendal and Barrow Island Groups	Ningaloo Reef Exmouth Gulf Shark Bay	**Section 10**
Filter Feeders/ heterotrophic	Filter feeder epifauna such as sponges, ascidians, soft corals and gorgonians are animals that feed by actively filtering suspended matter and food particles from water, by passing the water over specialised filtration structures (DEWHA, 2007a). Filter feeders generally live in areas that have strong currents and hard substratum. Conversely, higher diversity infauna are mainly associated with soft unconsolidated sediment and infauna communities are considered widespread and well represented along the continental shelf and upper slopes of the NWMR. In nearshore areas of the NWMR, these species are generally found around reef systems.			
	-	Deeper habitats of Rankin Bank and Glomar Shoal	Deeper habitats of Ningaloo Reef and the protected sponge zone in the south	

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Habitat/Community	Browse	NWS / Scarborough	North-west Cape	Reference
Mangroves	Mangroves grow in intertidal mud and sand, with specially adapted aerial roots (pneumatophores) that provide for gas exchange during low tide (McClatchie *et al.*, 2006). Mangrove forests can help stabilise coastal sediments, provide a nursery ground for many species of fish and crustacean, and provide shelter or nesting areas for seabirds (McClatchie *et al.*, 2006). Mangroves are confined to shoreline habitats, in nearshore areas of the NWMR.			
	Dampier Peninsula (including Carnot Bay, Beagle Bay and Pender Bay)	Pilbara Coastline (including; Ashburton River Delta, Coolgra Point, Robe River Delta, Yardie Landing, Yammadery Island and the Mangrove Islands) Montebello, Lowendal and Barrow Island Groups Roebuck Bay	Shark Bay Mangrove Bay, Cape Range Peninsula Exmouth Gulf	
Saltmarshes	Saltmarshes communities are confined to shoreline habitats and are typically dominated by dense stands of halophytic plants such as herbs, grasses, and low shrubs. The diversity of saltmarsh plant species increases with increasing latitude (in contrast to mangroves). The vegetation in these environments is essential to the stability of the saltmarsh, as they trap and bind sediments. The sediments are generally sandy silts and clays and can often have high organic material content.			
	-	Eighty Mile Beach Roebuck Bay	Shark Bay	
Sandy Beaches	Sandy beaches are dynamic environments, naturally fluctuating in response to external forcing factors (e.g. waves, currents, etc). Sandy beaches vary in length, width and gradient, and in sediment type, composition, and grain size throughout the NWMR. Sandy beaches are important for both resident and migratory seabirds and shorebirds and can also provide an important habitat for turtle nesting and breeding. They are located along many coastlines of the nearshore environments of the NWMR.			
	Cape Domett Lacrosse Island	Eighty Mile Beach Eco Beach Dampier Archipelago Inshore Pilbara Islands (Northern, Middle, and Southern)	Ningaloo coast Muiron Islands Exmouth Gulf	

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Table 4-2 Habitats within the SWMR

Habitat/Community	Location
Offshore	
Soft sediment with infauna	Most of the SWMR seafloor is composed of soft unconsolidated sediments, but due to large variations in bathymetry there are marked differences in sedimentary composition and benthic assemblage structure across the region. Despite the prevalence of these habitats in the SWMR, very little is known about the composition or distribution of the region's sedimentary infauna (DEWHA, 2008b)
Soft sediment with hard substrate outcropping	A unique seafloor feature combining both soft sediment and hard substrates, including outcrops, terraces, continental slope, and escarpments.
	Perth Canyon Marine Park Ancient coastline at 90-120 m depth contour KEF Diamantina Fracture Zone Naturaliste Plateau
Coral Reef	To date, studies and understanding of the corals within the SWMR have concentrated on the shallow water areas in State Waters. Within the deeper Commonwealth waters of the SWMR little is known of the distribution of corals.
Filter Feeders/ heterotrophic	Filter feeder epifauna such as sponges, ascidians, soft corals and gorgonians are animals that feed by actively filtering suspended matter and food particles from water, by passing the water over specialised filtration structures (DEWR, 2007). Filter feeders generally inhabit deeper habitat (below the photic zone) that have strong currents and hard substratum
	Ancient coastline at 90-120 m depth Diamantina Fracture Zone Naturaliste Plateau Perth Canyon Marine Park South-west Corner Marine Park
Nearshore	
Coral Reef	The northern extent of the SWMR coincides loosely with the disappearance of abundant and diverse coral from coastal habitats. To the south of Shark Bay, abundant corals occur predominantly around offshore islands, with corals at inshore sites occurring in very isolated patches of non-reef coral communities, usually of reduced species richness.
	Houtman Abrolhos Islands Rottnest Island
Seagrass and Macroalgae communities	Within the SWMR, macroalgae and seagrass communities are noted for their extent, species richness and endemism. The clear waters of the region allow light to reach greater depths, with some species found at much greater depths than usual (down to 120 m) (DEWR, 2007). Of the known species there are more than 1000 species of macro-algae and 22 species of seagrass consisting of tropical and temperate species. Seagrass and macro-algae occur in areas with sheltered bays and in the inter-reef lagoons along exposed sections of the coast.
	Houtman Abrolhos Islands Jurien Marine Park Shoalwater Islands Marine Park Geographe Marine Park Cockburn Sound Rottnest Island

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Habitat/Community	Location
	Commonwealth marine environment within and adjacent to the west-coast inshore lagoons KEF Commonwealth marine environment within and adjacent to Geographe Bay KEF Commonwealth marine environment surrounding the Recherche Archipelago KEF
Filter Feeders/ heterotrophic	Filter feeder epifauna such as sponges, ascidians, soft corals and gorgonians are animals that feed by actively filtering suspended matter and food particles from water, by passing the water over specialised filtration structures (DEWR, 2007). Filter feeders generally live in areas that have strong currents and hard substratum.
	Houtman Abrolhos Islands Recherche Archipelago
Mangroves	Mangroves grow in intertidal mud and sand, with specially adapted aerial roots (pneumatophores) that provide for gas exchange during low tide (McClatchie *et al.*, 2006). Mangrove forests can help stabilise coastal sediments, provide a nursery ground for many species of fish and crustacean, and provide shelter or nesting areas for seabirds (McClatchie *et al.*, 2006). Mangroves are confined to shoreline habitats, in nearshore areas of the SWMR.
	Houtman Abrolhos Islands
Sandy Beaches	Sandy beaches within the SWMR are important for both resident and migratory seabirds and shorebirds and can also host breeding populations of the Australian sea lion. They are found along many coastlines of the nearshore environments of the SWMR. In addition to this, beaches in the SWMR provide a variety of socio-economic values including tourism, commercial and recreational fishing, and support other recreational activities.
	Houtman Abrolhos Islands Marmion Marine Park Ngari Capes Marine Park Walpole and Nornalup Inlets Marine Park

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Table 4-3 Habitats and Biological Communities within the NMR

Habitat/Community	Location
Offshore habitats and biological communities	
Soft sediment with infauna	Most of the offshore environment of the NMR is characterised by relatively flat expanses of soft sediment seabed. The soft sediments of the region are characterised by moderately abundant and diverse communities of infauna and mobile epifauna dominated by polychaetes, crustaceans, molluscs, and echinoderms.
Soft sediment with hard substrate outcropping	A unique seafloor feature combining both soft sediment and hard substrates, including outcrops, terraces, continental slope, and escarpments. The variability in substrate composition may contribute to the presence of unique ecosystems. Species present include sponges, soft corals and other sessile filter feeders associated with hard substrate sediments.
	Carbonate bank and terrace system of the Van Diemen Rise KEF Pinnacles of the Bonaparte Basin KEF
Coral Reef	Offshore coral reefs within the NMR is generally associated with a series of submerged shoals and banks. The shoals/banks in the region support tropical marine biota consistent with that found on emergent reef systems of the Indo West Pacific region such as Ashmore Reef, Cartier Island, Seringapatam Reef and Scott Reef (Heyward *et al.,* 1997)
	Pinnacles of the Bonaparte Basin KEF Evans Shoal Tassie Shoal Blackwood Shoal
Filter Feeders/ heterotrophic	Filter feeder epifauna such as sponges, ascidians, soft corals and gorgonians are animals that feed by actively filtering suspended matter and food particles from water, by passing the water over specialised filtration structures (DEWHA, 2007b). Filter feeders generally live in areas that have strong currents and hard substratum and typically associated with the deeper habitats of the submerged shoals and banks, and canyon features.
	Carbonate bank and terrace system of the Van Diemen Rise KEF Pinnacles of the Bonaparte Basin KEF Tributary Canyons of the Arafura Depression KEF Evans Shoal Tassie Shoal Goodrich Bank
Nearshore	
Coral Reef	Within the NMR corals occur both as reefs and in non-reef coral communities. Nearshore reefs include patch reefs and fringing reefs sparsely distributed within the region. Coral reefs within the NMR provides breeding and aggregation areas for many fish species including mackerel and snapper and offer refuges for sea snakes and apex predators such as sharks.
	Submerged coral reefs of the Gulf of Carpentaria KEF Darwin Harbour
Seagrass and Macroalgae communities	Seagrasses provide key habitats in the NMR. They stabilise coastal sediments and trap and recycle nutrients. They provide nursery grounds for commercially harvested fish and prawns and provide feeding grounds for dugongs and green turtles. Seagrass distribution in the region is largely associated with sheltered small bays and inlets including shallow waters surrounding inshore islands.
	Field Island The mainland coastline adjacent to Kakadu National Park

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Habitat/Community	Location
Filter Feeders/ heterotrophic	Filter feeder epifauna such as sponges, ascidians, soft corals, and gorgonians are animals that feed by actively filtering suspended matter and food particles from water, by passing the water over specialised filtration structures (DEWHA, 2007b). Filter feeders generally live in areas that have strong currents and hard substratum.
	Cape Helveticus
Mangroves	Mangroves grow in intertidal mud and sand, with specially adapted aerial roots (pneumatophores) that provide for gas exchange during low tide (McClatchie *et al.*, 2006). Mangroves provide habitat for waterbirds and support many commercially and recreationally important fish and crustacean species for parts of their life cycles. They buffer the coast from large tidal movements, storm surges and flooding.
	Tiwi Islands Darwin Harbour The mainland coastline adjacent to the Daly River
Sandy Beaches	Sandy beaches vary in length, width and gradient, and in sediment type, composition, and grain size throughout the NMR and are important for both resident and migratory seabirds and shorebirds. Sandy beaches can also provide an important habitat for turtle nesting. They are located along many coastlines of the nearshore environments of the islands and mainland shores of the NMR.
	Tiwi Islands Cobourg Peninsula Joseph Bonaparte Gulf

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5. FISHES, SHARKS AND RAYS

5.1 Regional Context

Western Australian waters provide important habitat for listed fishes, sharks, and rays including areas that support key life stages such as breeding, foraging, and migration routes for fish species. Pelagic and demersal fishes occupy a range of habitats throughout each of the regions, from coral reefs to open offshore waters, and are an extremely important component of ecosystems, providing a link between primary production and higher predators, with many species being of conservation value and important for commercial and recreational fishing.

The fish fauna in the NWMR is diverse. Of the approximately 500 shark species found worldwide, 94 are found in the region (DEWHA, 2008). Approximately 54 species of syngnathids (seahorses, seadragons, pipehorses and pipefishes) and one species of solenostomids (ghostpipefishes) are also known to occur in the NWMR or adjacent State waters (DSEWPAC, 2012a).

The fish fauna of the SWMR includes more than 900 species occupying a large variety of habitats. However, only three species of bony fishes known to occur in the region are listed under the EPBC Act as threatened or marine species, and seven listed species of shark (DSEWPAC, 2012b).

The NMR is considered an important area for the sawfish and river shark species group, with five species of sawfishes and river sharks listed under the EPBC Act known to occur in the region (DSEWPAC, 2012c). Approximately 28 species of syngnathids and two species of solenostomids are listed marine and known to occur in the NMR, however there is a paucity of knowledge on the distribution, relative abundance and habitats of these species in the region (DEWHA, 2008).

The following sections focus on the fish species (including sharks and rays) listed as threatened or migratory that are known to occur within the NWMR. In addition, listed, conservation dependent fish and shark species for the NWMR are described. A detailed account of commercial and recreational fisheries that operate in the region is provided in **Section 11**.

Table 5-1 outlines the threatened and migratory fish species that may occur within the NWMR, with their conservation status and relevant recovery plans and/or conservation advice. **Table 5-2** provides information for species of fish that are listed as conservation dependent that may occur within the NWMR, NMR and SWMR. Note that currently there are no approved Conservation Advices in place for any of these five species.

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Table 5-1 Fish species (including sharks and rays) identified by the EPBC Act PMST for the NWMR

Species Name	Common Name	*Environment Protection and Biodiversity Conservation Act 1999*			WA *Biodiversity Conservation Act 2016*	EPBC Act Part 13 Statutory Instrument
		Threatened Status	Migratory Status	Listed	Conservation Status	
Rhincodon typus	Whale shark	Vulnerable	Migratory	Marine	Other specially protected fauna	Conservation Advice *Rhincodon typus* whale shark. (Threatened Species Scientific Committee, 2015d)
Carcharias taurus	Grey nurse shark (west coast population)	Vulnerable	N/A	Marine	Vulnerable	Recovery Plan for the Grey Nurse Shark (*Carcharias taurus*) (DOE, 2014a)
Carcharodon carcharias	White shark	Vulnerable	Migratory	Marine	Vulnerable	Recovery Plan for the White Shark (*Carcharodon carcharias*) (DSEWPAC, 2013b)
Isurus oxyrinchus	Shortfin mako	N/A	Migratory	Marine	N/A	N/A
Isurus paucus	Longfin mako	N/A	Migratory	Marine	N/A	N/A
Lamna nasus	Porbeagle shark Mackerel shark	N/A	Migratory	Marine	N/A	N/A
Carcharhinus longimanus	Oceanic whitetip shark	N/A	Migratory	Marine	N/A	N/A
Anoxypristis cuspidata	Narrow sawfish	N/A	Migratory	Marine	N/A	N/A
Pristis clavata	Dwarf sawfish	Vulnerable	Migratory	Marine	Priority	Sawfish and River Sharks Multispecies Recovery Plan (Commonwealth of Australia, 2015b)
Pristis pristis	Largetooth (Freshwater) sawfish	Vulnerable	Migratory	Marine	Priority	
Pristis zijsron	Green sawfish	Vulnerable	Migratory	Marine	Vulnerable	
Glyphis garricki	Northern river shark	Endangered	N/A	Marine	Priority	
Manta alfredi	Reef manta ray	N/A	Migratory	Marine	N/A	N/A
Manta birostris	Giant manta ray	N/A	Migratory	Marine	N/A	N/A

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Table 5-2 EPBC Act listed Conservation Dependent species of fishes and sharks that may occur in the NWMR, NMR and SWMR

Species Name	Common Name	Likely Occurrence / Distribution	Listing Advice
Hoplostethus atlanticus	Orange roughy, Deep-sea perch, Red roughy	SWMR	No conservation listing advice for this species. Refer to the Marine bioregional plan for the SWMR (DSEWPAC, 2012b) for further information
Thunnus maccoyii	Southern bluefin tuna	NWMR and SWMR	Threatened Species Scientific Committee (2010)
Sphyrna lewini	Scalloped hammerhead	NWMR, NMR and SWMR	Threatened Species Scientific Committee (2018)
Centrophorus zeehaani	Southern dogfish, Endeavour dogfish, Little gulper shark	SWMR	Threatened Species Scientific Committee (2013)
Galeorhinus galeus	School shark, Eastern school shark, Snapper shark, Tope, Soupfin shark	SWMR	Threatened Species Scientific Committee (2009)

5.2 Protected Sharks, Sawfishes and Rays in the NWMR

The EPBC Act Protected Matters search (**Appendix A**) identified seven species of shark and five species of river shark or sawfish listed as threatened and/or migratory within the NWMR. In addition, two species of ray (the reef manta ray and giant manta ray) are listed as migratory within the region (refer **Table 5-2**).

5.2.1 Sharks and Sawfishes

The shark species known to occur within the NWMR include: the whale shark, grey nurse shark, white shark, shortfin mako, and longfin mako (**Table 5-2**).

Five species of river shark or sawfish known to occur in the NWMR and include: the narrow sawfish, northern river shark, freshwater sawfish, green sawfish and dwarf sawfish (**Table 5-2**).

There are identified BIAs within the NWMR for the whale shark, freshwater sawfish, green sawfish, and dwarf sawfish (refer **Section 5.3.2**).

Table 5-2 Information on the threatened shark and sawfish species within the NWMR

Species	Preferred Habitat and Diet	Habitat Location
Whale shark	Preferred habitat: They have a widespread distribution in tropical and warm temperate seas, both oceanic and coastal (Last and Stevens, 2009). The species is widely distributed in Australian waters. Diet: Whale sharks are planktivorous sharks and feed on a variety of planktonic organisms including krill, jellyfish, and crab larvae (Last and Stevens, 2009).	Ningaloo Reef is the main known aggregation site for whale sharks in Australian waters and has the largest density of whale sharks per kilometre in the world (Martin, 2007). Refer **Table 5-3** for the BIA summary for the whale shark.
Grey nurse shark (west coast population)	Preferred habitat: Most commonly found in temperate waters on, or close to, the bottom of the continental shelf, from close inshore to depths of about 200 m (McAuley, 2004). Diet: A variety of teleost and elasmobranch fishes and some cephalopods (Gelsleichter *et al.*, 1999; Smale, 2005).	Details of movement patterns of the western sub-population are unclear (McAuley, 2004) and key aggregation sites have not been formally identified within the NWMR (Chidlow *et al.*, 2006). The NWMR represents the northern limit of the west coast population.

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Species	Preferred Habitat and Diet	Habitat Location
White shark	Preferred habitat: The species typically occurs in temperate coastal waters between the shore and the 100 m depth contour; however, adults and juveniles have been recorded diving to depths of 1000 m (Bruce *et al.*, 2006; Bruce, 2008). Diet: Smaller white sharks (less than 3 m in length) feed primarily on teleost and elasmobranch fishes, broadening their diet as larger sharks to include marine mammals (Last and Stevens, 2009).	There are no known aggregation sites for white sharks in the NWMR, and this species is most often found south of North-west Cape, in low densities (DSEWPAC, 2012a). Given the migratory nature of the species, most likely has a broad distribution within the NWMR. No BIAs identified for NWMR.
Shortfin mako	Preferred habitat: The shortfin mako shark is a pelagic species with a circumglobal, wide-ranging oceanic distribution in tropical and temperate seas (Mollet *et al.*, 2000). Tagging studies indicate shortfin makos spend most of their time in water less than 50 m deep but with occasional dives up to 880 m (Abascal *et al.*, 2011; Stevens *et al.*, 2010). Diet: Feeds on a variety of prey, such as teleost fishes, other sharks, marine mammals, and marine turtles (Campana *et al.*, 2005).	Given the migratory nature of the species, most likely has a broad distribution within the NWMR. No BIAs identified for NWMR.
Longfin mako	Preferred habitat: A pelagic species with a wide-ranging oceanic distribution in tropical and temperate seas (Mollet *et al.*, 2000). Diet: Primarily teleost fishes and cephalopods (primarily squid) (Last and Stevens, 2009).	Records on longfin mako sharks are sporadic and their complete geographic range is not well known (Reardon *et al.*, 2006). Given the migratory nature of the species, most likely has a broad distribution within the NWMR. No BIAs identified for NWMR.
Mackerel/Porbeagle shark	Preferred habitat: The porbeagle shark primarily inhabits offshore waters around the edge of the continental shelf. They occasionally move into coastal waters, but these movements are temporary (Campana and Joyce, 2004; Francis *et al.*, 2002). The porbeagle shark is known to dive to depths exceeding 1300 m (Campana *et al.*, 2010; Saunders *et al.*, 2011). Diet: Primarily teleost fish, elasmobranchs, and cephalopods (primarily squid) (Joyce *et al.*, 2002; Last and Stevens, 2009).	In Australia, the species occurs in waters from southern Queensland to south-west Australia (Last and Stevens, 2009). Distribution within the NWMR is unknown, but there are several records for this species on the NWS in the Atlas of Living Australia (ALA).
Oceanic whitetip shark	Preferred habitat: The oceanic whitetip shark is globally distributed in warm-temperate and tropical oceans (Andrzejaczek *et al.*, 2018). The species may occur in tropical and sub-tropical offshore and coastal waters around Australia. They primarily occupy pelagic waters in the upper 200 m of the water column; however, they have been observed diving to depths of around 1000 m, potentially associated with foraging behaviour (Howey-Jordan *et al.*, 2013; D'Alberto *et al.*, 2017). The species is highly migratory, travelling large distances between shallow reef habitats in coastal waters and oceanic waters (Howey-Jordan *et al.*, 2013). The species does exhibit a strong preference for warm and shallow waters above 120 m. Diet: Opportunistic feeders and generally target a variety of finfishes and pelagic squid, depending on habitat. Target pelagics such as tuna in open ocean as noted by the large bycatch numbers in the long line fisheries.	Given the migratory nature of the species, most likely has a broad distribution within the NWMR. No BIAs identified for NWMR.

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Species	Preferred Habitat and Diet	Habitat Location
Narrow sawfish	Preferred habitat[1]: Shallow coastal, estuarine, and riverine habitats, however it may occur in waters up to 40 m deep (D'Anastasi *et al.*, 2013). Diet: Shoaling fishes, such as mullet, as well as molluscs and small crustaceans (Cliff and Wilson, 1994).	Shallow coastal waters of the Pilbara and Kimberly coasts (Last and Stevens, 2009).
Northern river shark	Preferred habitat[1]: Rivers, tidal sections of large tropical estuarine systems and macrotidal embayments, as well as inshore and offshore marine habitats (Pillans *et al.*, 2009; Thorburn and Morgan, 2004). Adults have been recorded only in marine environments. Juveniles and sub-adults have been recorded in freshwater, estuarine and marine environments (Pillans *et al.*, 2009). Diet: Variety of fish and crustaceans (Stevens *et al.*, 2005)	Within the NWMR records have come from both the west and east Kimberley, including King Sound, the Ord and King rivers, West Arm of Cambridge Gulf and also from Joseph Bonaparte Gulf (Thorburn and Morgan, 2004; Stevens *et al.*, 2005; Thorburn, 2006; Field *et al.*, 2008; Pillans *et al.*, 2008, Whitty *et al.*, 2008; Wynen *et al.*, 2008).
Largetooth (Freshwater) sawfish	Preferred habitat: Sandy or muddy bottoms of shallow coastal waters, estuaries, river mouths and freshwater rivers, and isolated water holes. Diet: Shoaling fishes, such as mullet, as well as molluscs and small crustaceans (Cliff and Wilson, 1994).	Refer **Table 5-3** for the BIA summary for the freshwater sawfish.
Green sawfish	Preferred habitat[1]: Inshore coastal environments including estuaries, river mouths, embayments, and along sandy and muddy beaches, as well as offshore marine habitat (Stevens *et al.*, 2005; Thorburn *et al.*, 2003). Diet: Schools of baitfish and prawns (Poganoski *et al.*, 2002), molluscs and small crustaceans (Cliff and Wilson, 1994).	Refer **Table 5-3** for the BIA summary for the green sawfish.
Dwarf sawfish	Preferred habitat[1]: Shallow (2 to 3 m) silty coastal waters and estuarine habitats, occupying relatively restricted areas and moving only small distances (Stevens *et al.*, 2008) Diet: Shoaling fish such as mullet, molluscs, and small crustaceans (Cliff and Wilson, 1994).	Refer **Table 5-3** for the BIA summary for the dwarf sawfish.

1 Preferred habitat as described within the Sawfish and River Sharks Multispecies Recovery Plan (Commonwealth of Australia, 2015b).

5.2.2 Rays

Rays are commonly found in the NWMR. Two listed and migratory species of ray known to occur within the NWMR: the reef manta ray and giant manta ray.

No BIAs for either the reef or giant manta ray species have been identified in the NWMR.

Table 5-3 Information on migratory ray species within the NWMR

Species	Preferred Habitat and Diet	Habitat Location
Reef manta ray	Preferred habitat: The reef manta ray is commonly sighted within productive nearshore environments, such as island groups, atolls or continental coastlines. However, the species has also been recorded at offshore coral reefs, rocky reefs, and seamounts (Marshall *et al.*, 2009). Diet: Feed on planktonic organisms including krill and crab larvae.	A resident population of reef manta rays has been recorded at Ningaloo Reef. No BIAs identified for NWMR.
Giant manta ray	Preferred habitat: The species primarily inhabits near-shore environments along productive coastlines with regular upwelling, but they appear	The Ningaloo Coast is an important area for giant manta rays from March to August (Preen *et al.*, 1997).

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Species	Preferred Habitat and Diet	Habitat Location
	to be seasonal visitors to coastal or offshore sites including offshore island groups, offshore pinnacles and seamounts (Marshall *et al.*, 2011). Diet: Feed on planktonic organisms including krill and crab larvae.	No BIAs identified for NWMR.

5.3 Fish, Shark and Sawfish Biological Important Areas in the NWMR

A review of the National Conservation Values Atlas identified Biologically Important Areas (BIAs) for four species of shark and sawfish (whale shark, freshwater sawfish, green sawfish and dwarf sawfish) within the NWMR. The BIAs for the whale shark and the sawfish species include foraging, nursing and pupping areas. These are described in **Table 5-4**.

Table 5-4 Fish, whale shark and sawfish BIAs within the NWMR

Species	Woodside Activity Area			BIAs		
	Browse	NWS/S	NWC	Pupping	Nursing	Foraging
Whale shark	✓	✓	✓	No pupping BIA identified within the NWMR	No nursing BIA identified within the NWMR	Foraging (high density) in Ningaloo Marine Park and adjacent Commonwealth waters (March–July) Foraging northward from Ningaloo along the 200 m isobath (July – Nov).
Green sawfish	✓	✓	-	Pupping in Cape Keraudren (pupping occurs in summer in a narrow area adjacent to shoreline) Pupping in Willie Creek Pupping in Roebuck Bay Pupping in Cape Leveque Pupping in waters adjacent to Eighty Mile Beach Pupping (likely) in Camden Sound.	Nursing in Cape Keraudren Nursing in waters adjacent to Eighty Mile Beach	Foraging in Cape Keraudren Foraging in Roebuck Bay Foraging in Cape Leveque Foraging in Camden Sound
Largetooth (freshwater) sawfish	✓	✓	-	Pupping in the mouth of the Fitzroy River (January to May) Roebuck Bay (Jan – May) Pupping likely in waters adjacent to Eighty Mile Beach	Nursing (likely) in King Sound Roebuck Bay (Jan – May)	Foraging in the mouth of the Fitzroy River (January to May) Foraging in King Sound Roebuck Bay (Jan – May) Foraging in waters adjacent to Eighty Mile Beach
Dwarf sawfish	✓	✓	-	Pupping in King Sound Pupping in waters adjacent to Eighty Mile Beach	Nursing in King Sound Nursing waters adjacent to Eighty Mile Beach	Foraging in King Sound Foraging in Camden Sound Foraging in waters adjacent to Eighty Mile Beach

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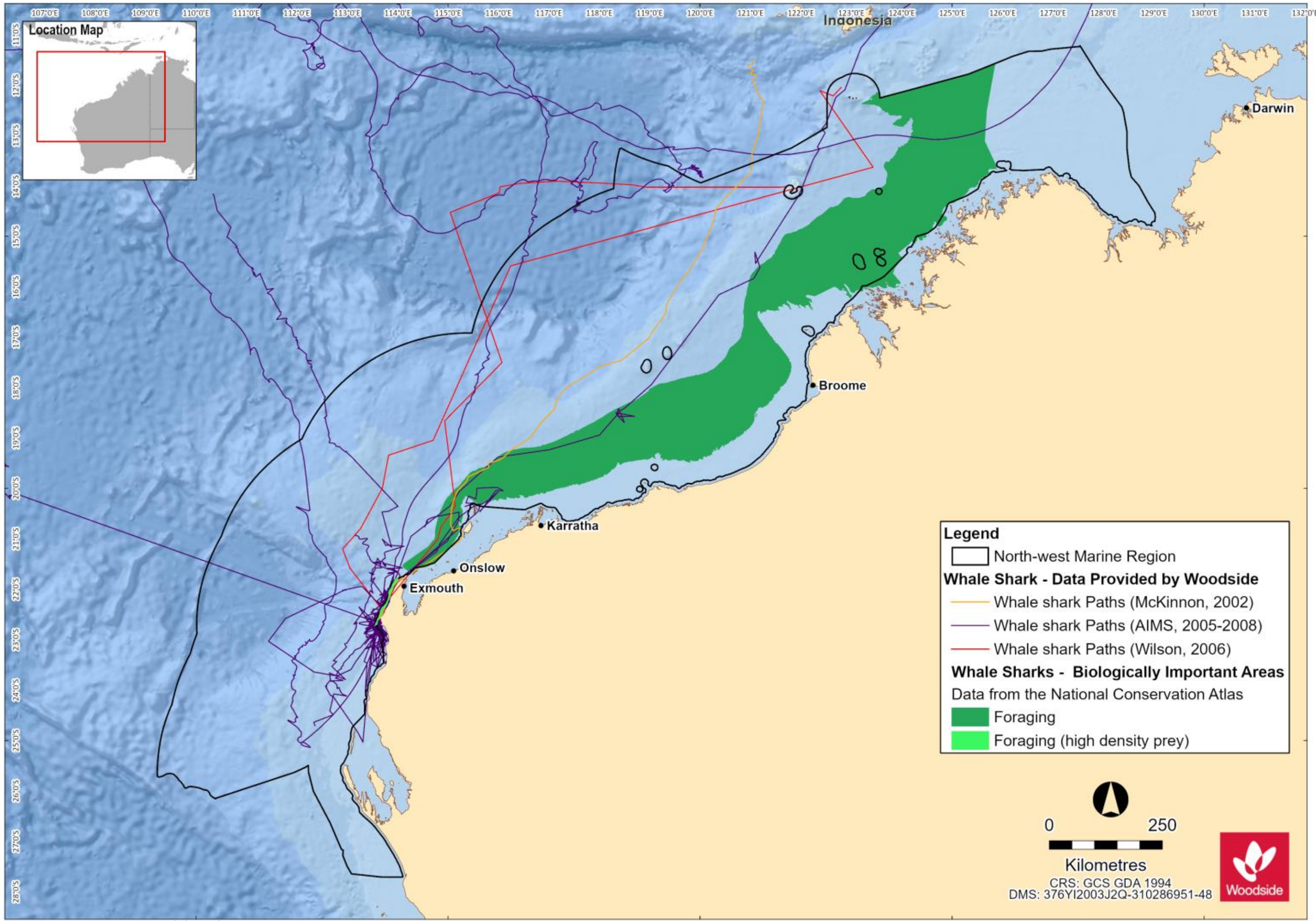

Basemap Esri, Garmin, GEBCO, NOAA NGDC, and other contributors

Figure 5-1 Whale shark BIAs for the NWMR and tagged whale shark tracks

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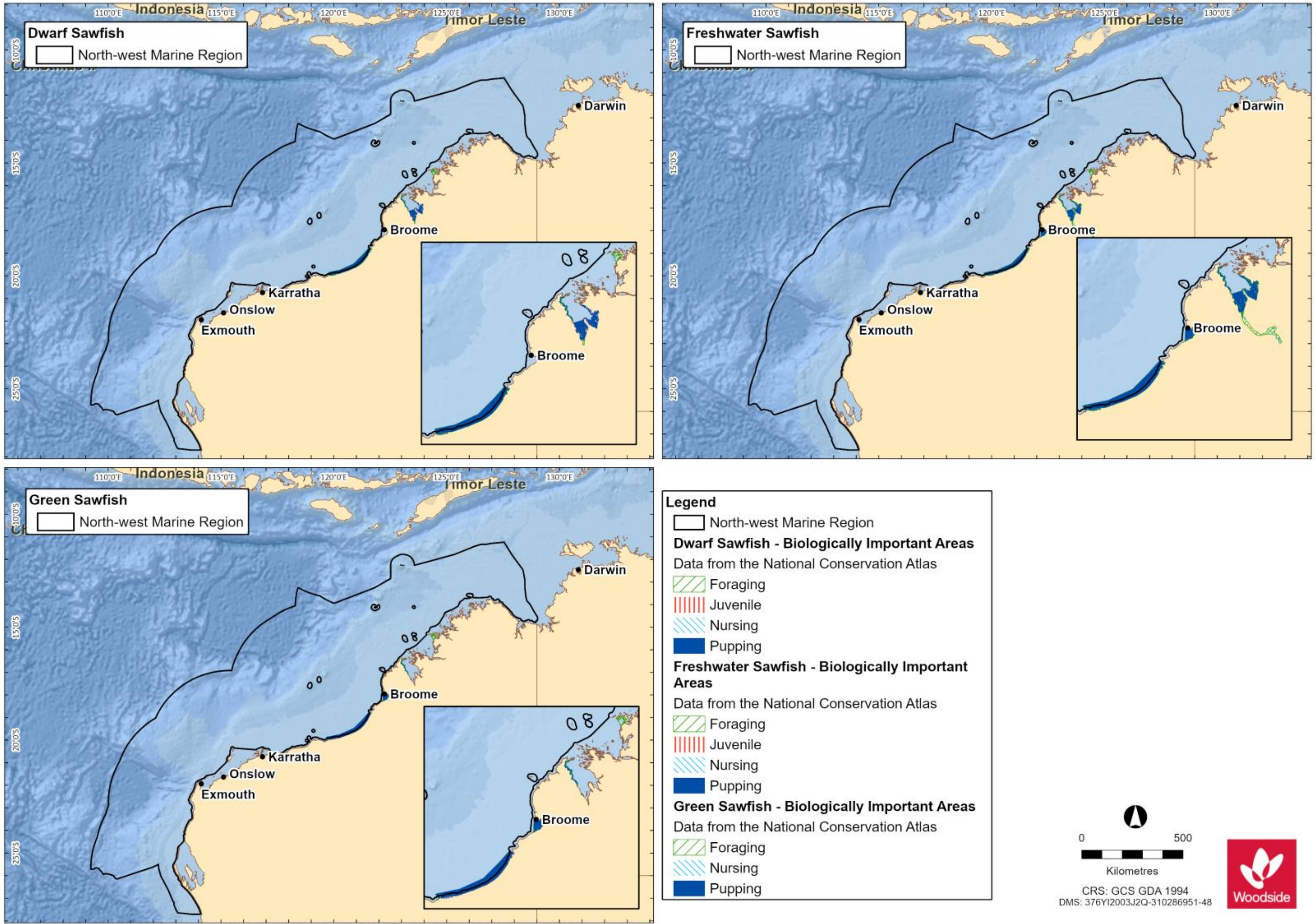

Basemap Esri, Garmin, GEBCO, NOAA NGDC, and other contributors, Sources: Esri, HERE, Garmin, GEBCO, National Geographic, NOAA, and the GIS User Community

Figure 5-2 Sawfish BIAs for the NWMR

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5.4 Fish Assemblages of the NWMR

5.4.1 Regional Context for Fish Assemblages of NWMR

The NWMR contains a diverse range of fishes of tropical Indo-west Pacific affinity (Allen *et al.*, 1988). The region is characterised by the highest level of endemism and species diversity compared with other areas of the Australian continental slope. Last *et al.* (2005) recorded 1431 species from the three bioregions encompassing the continental slope, whilst also acknowledging some information gaps.

The NWMR is known for its demersal slope fish assemblages; the continental slope of the Timor Province and the North-west Transition supports more than 418 and 505 species of demersal fishes respectively, of which 64 are considered to be endemic. This is the second richest area for demersal fish species across the entire Australian continental slope. Conversely, the broad Southern Province, which covers most of southern Australia, supports 463 species, only 26 possibly being endemic. The continental slope demersal fish assemblages of the NWMR have been identified as a KEF (DEWHA, 2008), as described in **Section 9**.

The NWMR also features a diversity of pelagic fishes (those living in the pelagic zone) and bentho-pelagic fishes, including tuna, billfish, bramids, lutjanids, serranids and some sharks (DEWHA, 2007a). These species feed on salps and jellyfish, and more often on secondary consumers such as squid and bait fish. Water depth provides an indication of the level of interaction between pelagic and benthic communities within the NWMR; in waters deeper than 1000 m, for instance, the trophic system is pelagically-driven and benthic communities rely on particulates that fall to the seafloor (DEWHA, 2007a).

Pelagic fishes play an important ecological role within the NWMR; small pelagic fishes, such as lantern fish, inhabit a range of marine environments, including inshore and continental shelf waters and form a vital link in and between many of the region’s trophic systems, feeding on pelagic phytoplankton and zooplankton and providing a food source for a wide variety of predators including large pelagic fishes, sharks, seabirds and marine mammals (Bulman, 2006; Mackie *et al.*, 2007). Large pelagic fishes, such as tuna, mackerel, swordfish, sailfish and marlin, are found mainly in oceanic waters and occasionally on the continental shelf (Brewer *et al.*, 2007). Both juvenile and adult phases of the large pelagic species are highly mobile and have a wide geographic distribution, although the juveniles more frequently inhabit warmer or coastal waters (DEWHA, 2008).

5.4.2 Listed Fish Species in the NWMR

The family Syngnathidae is a group of bony fishes that includes seahorses, pipefishes, pipehorses and seadragons. Along with syngnathids, members of the related Solenostomidae family (ghost pipefishes) are also found in the NWMR (DSEWPAC, 2012a).

There are 44 solenostomid and syngnathid species that are listed marine species that may occur within the NWMR, although no species is currently listed as threatened or migratory, according to the PMST report (**Appendix A**).

Syngnathids live in nearshore and inner shelf habitats, usually in shallow coastal waters, among seagrasses, mangroves, coral reefs, macroalgae dominated reefs, and sand or rubble habitats (Dawson, 1985; Lourie *et al.*, 1999, Lourie *et al.*, 2004; Vincent, 1996). Two species, the winged seahorse (*Hippocampus alatus*) and western pipehorse (*Solegnathus sp. 2*) have been identified in deeper waters of the NWMR (up to 200 m) (DSEWPAC, 2012a), however, these species were not identified by the Protected Matters search of the NWMR.

Knowledge about the distribution, abundance and ecology of both syngnathids and solenostomids in the NWMR is limited. No BIAs for syngnathids and solenostomids have been identified in the NWMR.

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5.4.3 Browse

The proposed Browse activity area includes biologically important habitat for the whale shark and three sawfish species:

- whale shark (foraging northward from Ningaloo along the 200 m isobath (July – Nov),
- freshwater sawfish (pupping, nursing and foraging areas),
- green sawfish (pupping, nursing and foraging areas); and
- dwarf sawfish (pupping, nursing and foraging areas).

BIAs for the shark and sawfish species are outlined in **Table 5-4** and **Figure 5-1**.

The proposed Browse activity area has partial overlap with the Continental slope demersal fish communities KEF.

5.4.4 NWS / Scarborough

The NWS / Scarborough activity area includes biologically important habitat for the whale shark and three sawfish species:

- whale shark (foraging northward from Ningaloo along the 200 m isobath (July – Nov),
- freshwater sawfish (pupping, nursing and foraging areas),
- green sawfish (pupping, nursing and foraging areas); and
- dwarf sawfish (pupping, nursing and foraging areas).

BIAs for the whale shark and sawfish species are outlined in **Table 5-4** and **Figure 5-1**.

The NWS / Scarborough activity area has partial overlap with the Continental slope demersal fish communities KEF. The continental slope between North-west Cape and the Montebello Trough has more than 500 fish species, 76 of which are endemic, which makes it the most diverse slope bioregion in Australia (Last *et al.*, 2005).

5.4.5 North-west Cape

The North-west Cape activity area includes biologically important foraging habitat for the whale shark:

- whale shark, including:
  - Foraging (high density) in Ningaloo Marine Park and adjacent Commonwealth waters (March–July); and
  - Foraging northward from Ningaloo along the 200 m isobath (July – Nov).

BIAs for the whale shark are outlined in **Table 5-4** and **Figure 5-1**.

The North-west Cape activity area coincides with part of the Continental slope demersal fish communities KEF.

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6. MARINE REPTILES

6.1 Regional Context for Marine Reptiles

The NWMR contains important habitat for listed marine reptiles, including areas that support key life stages such as nesting, internesting, migration and foraging for marine turtle species, and habitats supporting resident sea snake and crocodile populations.

Six of the seven marine turtle species occur in Australian waters, and all six (the green turtle, hawksbill turtle, loggerhead turtle, flatback turtle, leatherback turtle and olive ridley turtle) occur in the NWMR and NMR.

There are 25 listed species of sea snake reported within or adjacent to the NWMR (Guinea, 2007a; Udyawer *et al*., 2016), of which four are endemic to reef habitats in the remote parts of the region. Nineteen (19) listed sea snake species are known to occur in the NMR, as reported in the Protected Matters search (**Appendix A**).

There are significantly fewer marine reptile species that frequently occur within the SWMR and presently include three species of listed marine turtle and one sea snake species. Other species of sea snake may occur because of the southward-flowing Leeuwin Current, as vagrants in the region (DSEWPAC, 2012b).

The following sections focus on the listed marine reptile species known to occur within the NWMR.

Table 6-1 outlines the threatened and migratory marine reptile species that occur within the NWMR, with their conservation status and relevant recovery plans and/or conservation advice.

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Table 6-1 Marine reptile species identified by the EPBC Act PMST as potentially occurring within or utilising habitats in the NWMR for key life cycle stages

Species Name	Common Name	*Environment Protection and Biodiversity Conservation Act 1999*			WA *Biodiversity Conservation Act 2016*	EPBC Act Part 13 Statutory Instrument
		Threatened Status	Migratory Status	Listed	Conservation Status	
Caretta caretta	Loggerhead turtle	Endangered	Migratory	Marine	Endangered	Recovery Plan for Marine Turtles in Australia 2017-2027 (Commonwealth of Australia, 2017)
Chelonia mydas	Green turtle	Vulnerable	Migratory	Marine	Vulnerable	
Dermochelys coriacea	Leatherback turtle	Endangered	Migratory	Marine	Vulnerable	
Eretmochelys imbricata	Hawksbill turtle	Vulnerable	Migratory	Marine	Vulnerable	
Natator depressus	Flatback turtle	Vulnerable	Migratory	Marine	Vulnerable	
Lepidochelys olivacea	Olive ridley turtle	Endangered	Migratory	Marine	Vulnerable	
Aipysurus apraefrontalis	Short-nosed sea snake	Critically endangered	N/A	Marine	Critically endangered	Approved Conservation Advice for *Aipysurus apraefrontalis* (Short-nosed Sea Snake) (DSEWPAC, 2011a)
Aipysurus foliosquama	Leaf-scaled sea snake	Critically endangered	N/A	Marine	Critically endangered	Approved Conservation Advice for *Aipysurus foliosquama* (Leaf-scaled Sea Snake) (DSEWPAC, 2011b)
Crocodylus porosus	Salt-water crocodile	N/A	Migratory	Marine	Other protected fauna	N/A

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6.2 Marine Turtles in the NWMR

According to the Protected Matters search (**Appendix A**) six species of marine turtle known to occur within the NWMR are listed as threatened and migratory (three Vulnerable and three Endangered) under the EPBC Act—the green (*Chelonia mydas*), hawksbill (*Eretmochelys imbricata*), flatback (*Natator depressus*), loggerhead (*Caretta caretta*), leatherback (*Dermochelys coriacea*) and olive ridley (*Lepidochelys olivacea*) turtle (DSEWPAC, 2012a) (refer **Table 6-1**).

The NWMR supports globally significant breeding populations of four marine turtle species: the green, hawksbill, flatback and loggerhead turtle. Olive ridley turtles are known to forage within the NWMR, but there are only occasional records of the species nesting in the region. Leatherback turtles regularly forage over Australian continental shelf waters within the NWMR but there are also no records of the species nesting in the region (DSEWPAC, 2012a).

The six marine turtle species reported for the NWMR also occur within the NMR.

Three marine turtle species; the green, loggerhead, and leatherback turtle, have presumed feeding areas within the SWMR; however, no known nesting areas exist within the region (DSEWPAC, 2012b).

Discrete genetic stocks have evolved within each marine turtle species. This is the result of marine turtles returning to the location where they hatched. These genetically distinct stocks are defined by the presence of regional breeding aggregations. Stocks are composed of multiple rookeries in a region and are delineated by where there is little or no migration of individuals between nesting areas. Turtles from different stocks typically overlap at feeding grounds (Commonwealth of Australia, 2017). There are 17 genetic stocks across both the NWMR and NMR (nine in the NWMR, six in the NMR, and two overlapping both regions). Of these 17 genetic stocks, nine are known to occur within Woodside’s three areas of activity (**Table 6-2**).

6.2.1 Life Cycle Stages

Marine turtles are highly migratory during non-reproductive life phases and have high site fidelity during breeding and nesting life phases. Majority of their lives are spent in the ocean, but the adult female marine turtles will come ashore to lay eggs in the sand above the high water mark on natal beaches (Commonwealth of Australia, 2017). **Figure 6-1** summarises the generalised life cycle of marine turtles. Species-specific life cycle information is outlined within the Recovery Plan for Marine Turtles of Australia (Commonwealth of Australia, 2017).

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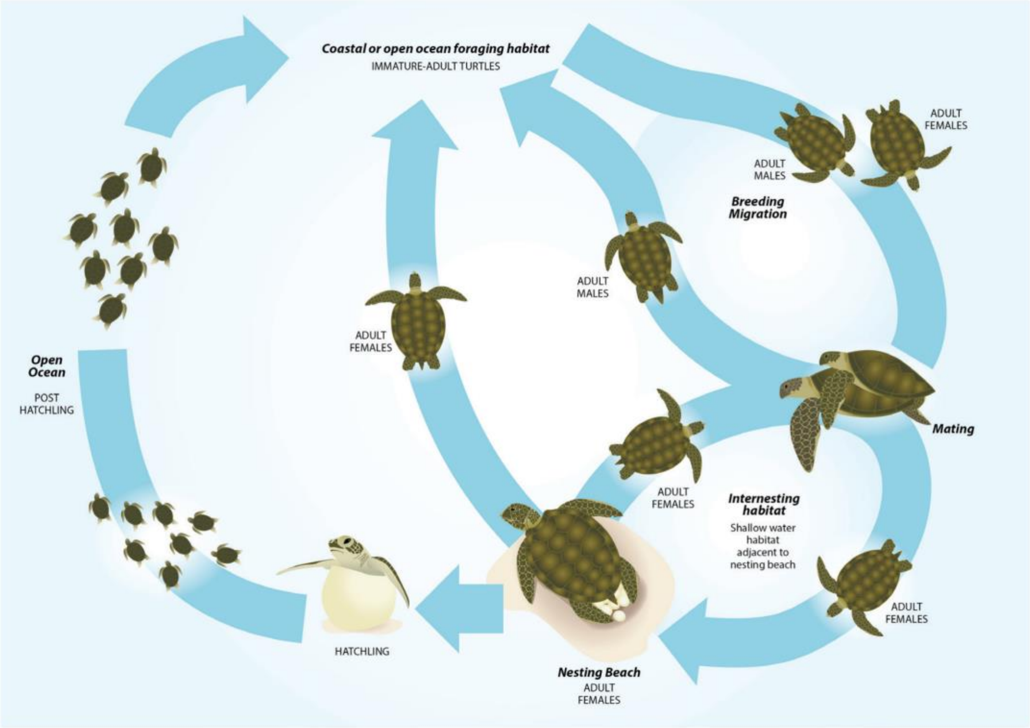

Figure 6-1 Generalised life cycle of marine turtles (Commonwealth of Australia, 2017)

6.2.2 Habitat Critical to Survival for Marine Turtles in the NWMR

The Recovery Plan for Marine Turtles of Australia (Commonwealth of Australia, 2017) identifies habitat critical to the survival of a species for marine turtle stocks under the EPBC Act. Habitat critical to survival is defined by the EPBC Act *Significant Impact Guidelines 1.1 – Matters of National Environmental Significance* as areas necessary:

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

The Recovery Plan for Marine Turtles of Australia (Commonwealth of Australia, 2017) has identified nesting locations and associated internesting areas as habitat critical to survival for four marine turtle species within the NWMR and these are identified, described and mapped in **Table 6-2** and **Figure 6-2**. No habitat critical to survival has been identified within the NWMR for olive ridley or leatherback turtles.

Table 6-2 outlines the relevant genetic stock, habitat critical to survival and key life cycle stage seasonality of the four species of marine turtles within the NWMR.

Table 6-2 Genetic stock, habitat critical to survival and key life cycle stage seasonality of the four species of marine turtles within the NWMR

Species	Woodside Activity Area			Habitat Critical to Survival			
	Browse	NWS/S	NWC	Nesting (* Major Rookery[1])	Internesting Buffer	Seasonality-Nesting	Preferred Habitat[2]
Green Turtle							
NWS Stock (G-NWS)	✓	✓	✓	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	20 km radius	Nov-Mar	Nearshore reef habitats in the photic zone.
Ashmore Reef Stock (G-AR)	✓	-	-	Ashmore Reef* Cartier Reef*		All year (peak: Dec-Jan)	
Scott Reef-Browse Island Stock (G-ScBr)	✓	-	-	Scott Reef (Sandy Islet)* Browse Island*		Nov-Mar	
Hawksbill Turtle							
Western Australia Stock (H-WA)	-	✓	-	Dampier Archipelago (including Rosemary Island and Delambre Island)* Montebello Islands (including Ah Chong Island, South East Island and Trimouille Island)* Lowendal Islands (including Varanus Island, Beacon Island and Bridled Island) Sholl Island	20 km radius	Oct-Feb	Nearshore and offshore reef habitats.

Species	Woodside Activity Area			Habitat Critical to Survival			
	Browse	NWS/S	NWC	Nesting (* Major Rookery[1])	Internesting Buffer	Seasonality-Nesting	Preferred Habitat[2]
Flatback Turtle							
Cape Domett Stock (F-CD)	✓	-	-	Cape Domett* Lacrosse Island	60 km radius	All year (peak: Jul-Sep)	Nearshore and offshore sub-tidal and soft bottomed habitats of offshore islands.
South-west Kimberley Stock (F-swKim)	-	✓	-	Eighty Mile Beach* Eco Beach* Lacepede Islands		Oct-Mar	
Pilbara Stock (F-Pil)	-	✓	-	Montebello Islands Mundabullangana Beach* Barrow Island* Cemetery Beach Dampier Archipelago (including Delambre Island* and Huay Island) Coastal islands from Cape Preston to Locker Island		Oct-Mar	
Unknown genetic stock Kimberley, Western Australia	✓	✓	-	Maret Islands Montilivet Islands Cassini Island Coronation Islands (includes Lamarck Island) Napier-Broome Bay Islands (West Governor Island, Sir Graham Moore Island – near Kalumbaru) Champagny, Darcy and Augustus Islands (Camden Sound)		May-July	

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Species	**Woodside Activity Area**			**Habitat Critical to Survival**			
	Browse	**NWS/S**	**NWC**	**Nesting (* Major Rookery[1])**	**Internesting Buffer**	**Seasonality-Nesting**	**Preferred Habitat[2]**
Loggerhead Turtle							
Western Australia Stock (LH-WA)	-	-	✓	Dirk Hartog Island* Muiron Islands* Gnaraloo Bay* Ningaloo coast	20 km radius	Nov-May	Nearshore and island coral reefs, bays and estuaries in tropical and warm temperate latitudes.

[1] *Major rookeries as outlined in the Recovery Plan (Commonwealth of Australia, 2017)*

[2] *Preferred habitat as outlined in the Recovery Plan (Commonwealth of Australia, 2017)*

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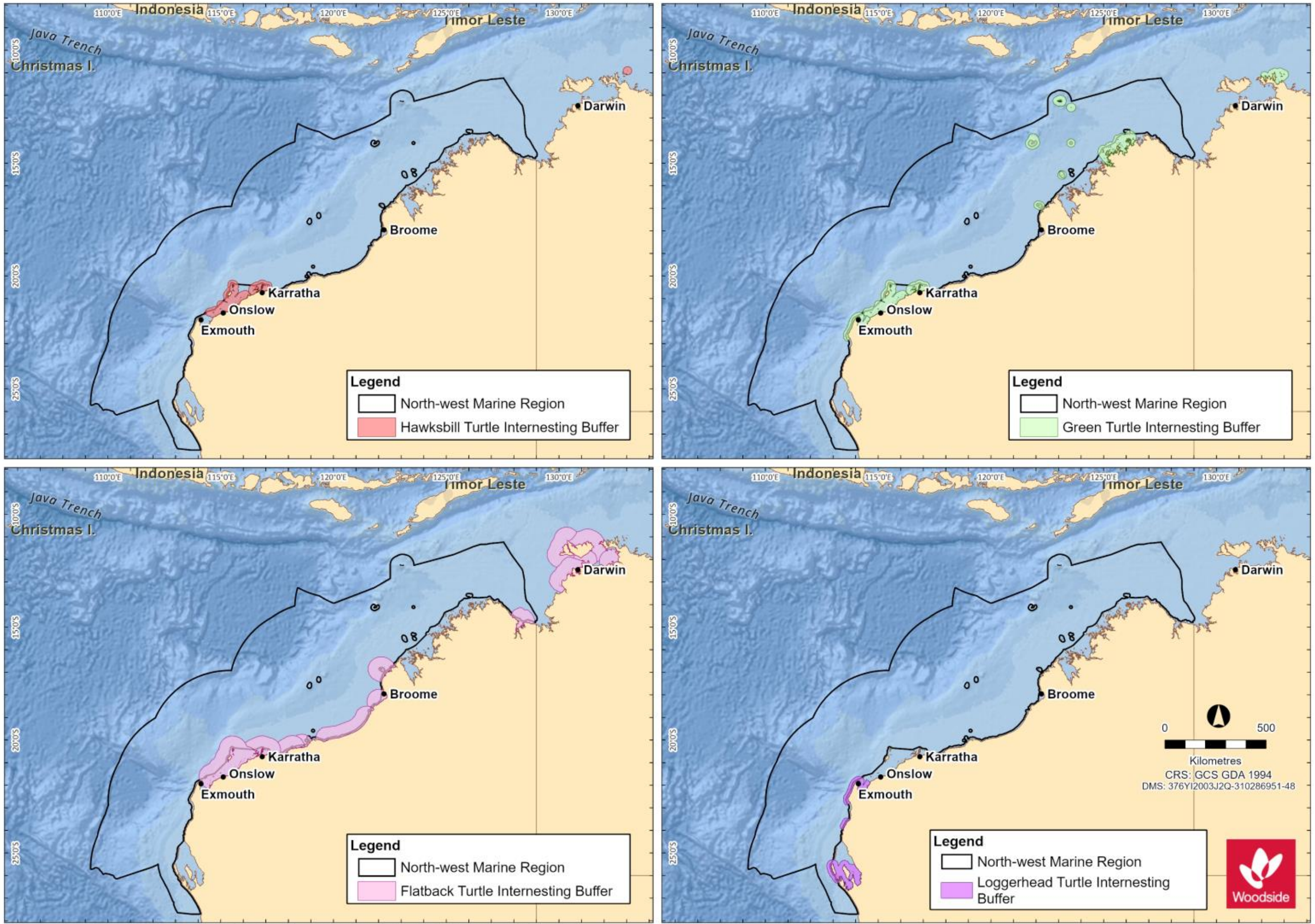

Basemap Sources: Esri, HERE, Garmin, GEBCO, National Geographic, NOAA, and the GIS User Community, Esri, Garmin, GEBCO, NOAA NGDC, and other contributors

Figure 6-2 Marine turtle species habitat critical to survival (nesting beaches and internesting buffers) for the NWMR

6.3 Marine Turtle Biological Important Areas in the NWMR

A review of the National Conservation Values Atlas (DAWE, 2020[2]) identified BIAs for the four marine turtle species that occur within the NWMR. These are described in **Table 6-3**. Note that nesting and internesting BIAs are not listed in **Table 6-3** as they are defined as in the Recovery Plan as habitat critical to survival for marine turtles nesting beaches and internesting areas (refer **Table 6-2**).

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[2] http://www.environment.gov.au/webgis-framework/apps/ncva/ncva.jsf

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Table 6-3 Marine turtle BIAs within the NWMR

Species	Woodside Activity Area			BIAs		
	Browse	NWS/S	NWC	Mating	Foraging	Migration[3]
Green turtle	✓	✓	✓	No mating BIA identified within the NWMR.	Foraging inshore areas of Barrow Island Foraging at Montgomery Reef Foraging at Montebello Islands Foraging at Dixon Island Foraging around Ashmore Reef Foraging at Seringapatam Reef and Scott Reef Foraging in the De Grey River area to Bedout Island Foraging around the Islands between Cape Preston and Onslow and inshore of Barrow Island Foraging around Dampier Archipelago (islands to the west of the Burrup Peninsula) Foraging at Legendre Island and Huay Island Foraging around Delambre Island Foraging in the Joseph Bonaparte Gulf Foraging in waters adjacent to James Price Point	Green turtles can migrate more than 2600 km between their feeding and nesting grounds. Individual turtles foraging in the same area do not necessarily take the same migration route (Limpus *et al.*, 1992). Ferreira et al. (2021) broadly identified two migratory corridors, one used by the NWS stock-Pilbara and another used by the NWS stock-Kimberley and the Scott-Browse stock with some overlap at the northern and southern extents respectively. This study showed that the foraging distribution of green turtles from two stocks in WA expands throughout north-west and northern Australian coastal waters, including the NT and Queensland.
Hawksbill turtle	✓	✓	✓	No mating BIA identified within the NWMR.	Foraging around the Lowendal Island group Foraging at Delambre Island Foraging around Dixon Island Foraging in the De Grey River area to Bedout Island Foraging around the islands between Cape Preston and	Individuals may migrate up to 2400 km between their nesting and foraging grounds (DSEWPAC, 2012a).

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[3] Migration BIA does not exist for Marine Turtles – general information provided.

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Species	Woodside Activity Area			BIAs		
	Browse	NWS/S	NWC	Mating	Foraging	Migration[3]
					Onslow and inshore of Barrow Island Foraging around the islands of the Dampier Archipelago (to the west of the Burrup Peninsula) Foraging at Ashmore Reef	
Flatback turtle	✓	✓	-	Lacepede Islands Mating at Montebello Islands Mating at Dampier Archipelago (islands to the west of the Burrup Peninsula) Mating at Barrow Island A year-round internesting buffer biologically important area (BIA) of 80 km is located north and north-west of the Montebello Islands, extending 20 km further than the habitat critical to survival. However, use level for this BIA has been defined as very low (Commonwealth of Australia, 2017) and the habitat critical to survival internesting buffer is the legally recognised area of protection under the EPBC Act *Significant Impact Guidelines 1.1 – Matters of National Environmental Significance* Refer to the Marine Bioregional Plan for the North-west Marine Region (DSEWPAC, 2012a) for locations of seasonal 80 km internesting buffer BIAs for flatback turtles	Foraging at the islands between Cape Preston and Onslow and inshore of Barrow Island. Foraging at Montebello Islands Foraging at Dampier Archipelago (islands to the west of the Burrup Peninsula) Foraging at Legendre Island and Huay Island Foraging at Delambre Island Foraging in the Joseph Bonaparte Depression Foraging in waters adjacent to James Price Point	There is evidence that some flatback turtles undertake long-distance migrations between breeding and feeding grounds (Limpus *et al.*, 1983). However, flatback turtles generally do not have a pelagic phase to their lifecycle. Instead, hatchlings grow to maturity in shallow coastal waters thought to be close to their natal beaches (DSEWPAC, 2012a).

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Species	Woodside Activity Area			BIAs		
	Browse	NWS/S	NWC	Mating	Foraging	Migration[3]
Loggerhead turtle	✓	✓	-	No mating BIA identified within the NWMR	Foraging in the De Grey River area to Bedout Island Foraging on the Western Joseph Bonaparte Depression Foraging in the waters adjacent to James Price Point	Adult loggerhead turtles dispersing from Dirk Hartog Island beaches (near Shark Bay) have remained within WA waters from southern WA to the Kimberley. Turtles dispersing from the North-west Cape–Muiron Islands nesting area have ranged north as far as the Java Sea and the north-western Gulf of Carpentaria, and to south-west WA (DSEWPAC, 2012).
Olive ridley turtle	✓	✓	-	No mating BIA identified within the NWMR	Foraging in the Western Joseph Bonaparte Depression and Gulf Foraging in the Dampier Archipelago (islands to the west of the Burrup Peninsula)	Migration routes and distances between nesting beaches and foraging areas are not known for Australian olive ridley turtles.

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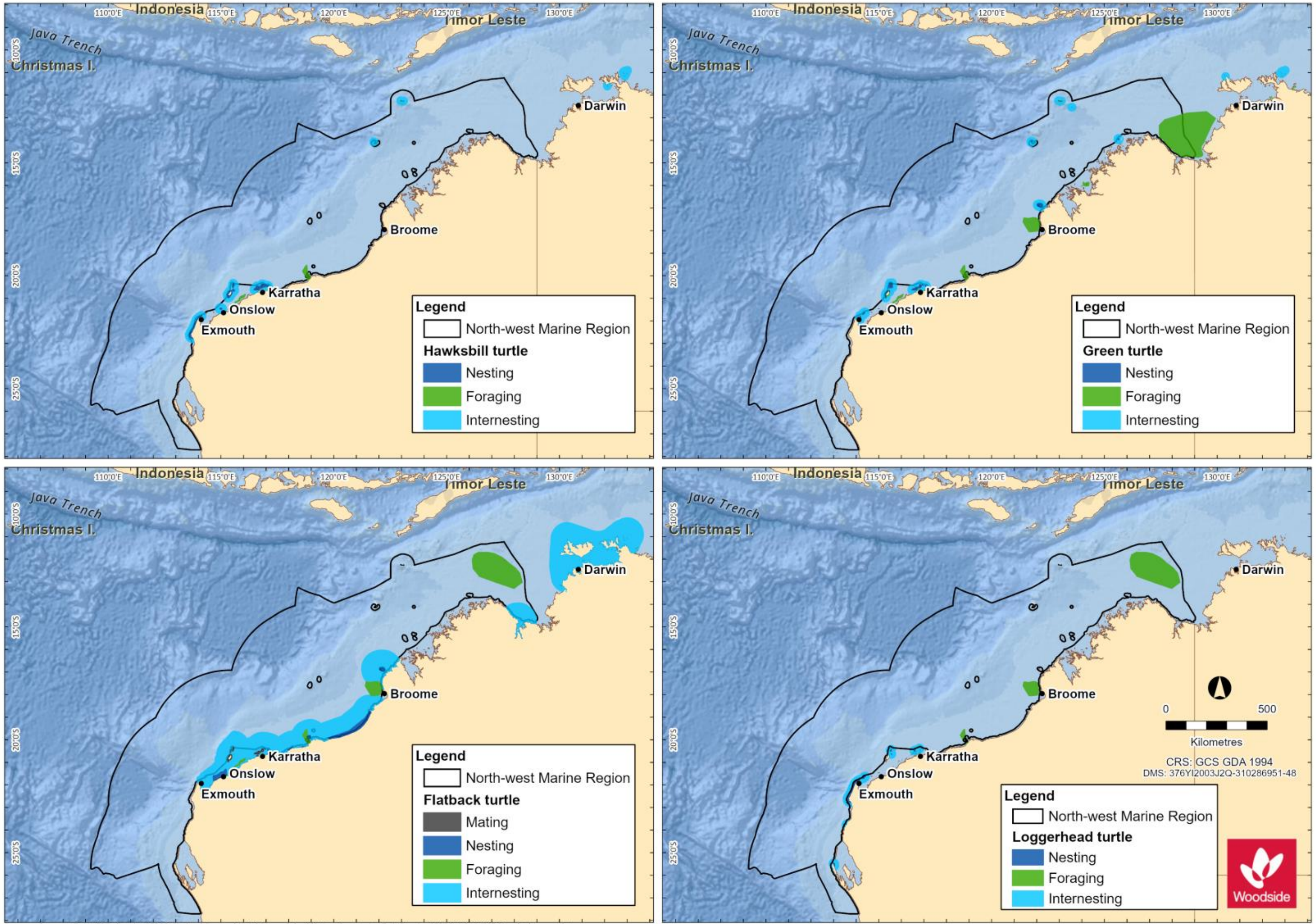

Basemap Sources: Esri, HERE, Garmin, GEBCO, National Geographic, NOAA, and the GIS User Community, Esri, Garmin, GEBCO, NOAA NGDC, and other contributors

Figure 6-3 Marine turtle species BIAs within the NWMR

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6.4 Marine Turtle Summary for NWMR

Six of the seven marine turtle species occur within the Woodside activity areas. Across all three areas, globally significant breeding populations of four marine turtle species; the green, hawksbill, flatback and loggerhead turtle, have been recorded.

However, offshore waters do not represent biologically important habitat for marine turtles in any of the three Woodside activity areas. Isolated records of transient individuals (on post-nesting migration) are expected, but there is no evidence of important habitat or behaviours for marine turtles in offshore, open water environment of the NWS, in general.

6.4.1 Browse

The proposed Browse activity area includes major nesting areas that support globally significant breeding populations of two marine turtle species:

- the green turtle, including two distinct genetic stocks (Ashmore Reef and Scott Reef-Browse Island); and
- the flatback turtle, Cape Domett genetic stock.

Locations of habitat critical for each of the two species are outlined in **Table 6-2** and **Figure 6-2**.

BIAs for the green and flatback turtle are outlined in **Table 6-3** and **Figure 6-3**.

Table 6-4 Marine turtle key information for Browse activity area

Species / Genetic Stock	Key Information
Green Turtle	
Ashmore Reef Stock (G-AR)	The G-AR stock nests in a localised area of the Indian Ocean in the Ashmore Reef and Cartier Island AMP areas. Population estimates are not available for Ashmore Reef, although annual breeding numbers are thought to be in the low hundreds (Whiting, 2000). Designated habitat critical for the G-AR stock are the nesting locations of Ashmore Reef and Cartier Reef, and an internesting buffer of 20 km radius around these rookeries, year-round with peak internesting activity occurring December to January (refer Table 6 of the Recovery Plan). Juvenile and adult turtles forage within the tidal/sub-tidal habitats of offshore islands and coastal waters with coral reef, mangrove, sand, rocky reefs, and mudflats where there are algal turfs or seagrass meadows present (Commonwealth of Australia, 2017).
Scott Reef-Browse Island Stock (G-ScBr)	The G-ScBr stock is a discrete unit known to nest at only two locations within the north-east Indian Ocean—Sandy Islet and Browse Island. There is currently very limited data available for the G-ScBr stock, therefore population numbers are not known. Designated habitat critical for the G-ScBr stock are the nesting locations of Sandy Islet and Browse Island, and an internesting buffer of 20 km radius around these rookeries, for the period November to March (refer Table 6 of the Recovery Plan). Surveys conducted at Scott Reef in 2006, 2008 and 2009 indicate that the summer months from late November to February are the preferred breeding season for green turtles at Sandy Islet (Guinea, 2009). Satellite tagging studies (Pendoley, 2005; Guinea, 2011) have provided an indication of the behaviour and migratory routes of adult green turtles leaving Scott Reef. Most animals appear to swim through South Reef lagoon and disperse toward the Western Australian mainland via two distinct post-nesting migration pathways; travelling east and north toward the Bonaparte Archipelago and then north along the coast to foraging areas in NT waters, or travelling south to Cape Leveque and then south along the coast to the Turtle Islands off the mouth of the De Grey River in the Pilbara region (Ferreira *et al*., 2021).

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Species / Genetic Stock	Key Information
Flatback Turtle	
Cape Domett Stock (F-CD)	Cape Domett is an important high density nesting area. Combined with a smaller site at Lacrosse Island, the F-CD stock is one of the largest flatback turtle stocks in Australia. Average nesting abundance at Cape Domett is estimated at 3250 females per year (Whiting *et al.*, 2008). Designated habitat critical for the F-CD stock are the nesting locations of Cape Domett and Lacrosse Island, and an internesting buffer of 60 km radius around these rookeries, year-round with peak internesting activity occurring July to September. Extending further than the habitat critical internesting buffer, an internesting buffer BIA of 80 km is located at Cape Domett and Lacrosse Island.

6.4.2 North-west Shelf / Scarborough

The NWS / Scarborough activity area includes major nesting areas that support globally significant breeding populations of three marine turtle species, representing four discreet genetic stocks:

- the green turtle, NWS genetic stock;
- the hawksbill turtle, WA genetic stock; and
- the flatback turtle, South-west Kimberley stock and Pilbara genetic stocks.

Locations of habitat critical for each of the four species are outlined in **Table 6-2** and **Figure 6-2**.

BIAs for the green, hawksbill, and flatback are outlined in **Table 6-3** and **Figure 6-3**.

Table 6-5 Marine turtle key information for NWS / Scarborough activity area

Species / Genetic Stock	Key Information
Green Turtle	
NWS Stock (G-NWS)	The G-NWS stock is one of the largest green turtle stocks in the world and the largest in the Indian Ocean. The G-NWS stock is estimated at approximately 20,000 individuals (DSEWPAC, 2012a) and the trend for the stock is reported as stable (Commonwealth of Australia, 2017). Major rookeries of the G-NWS stock within the NWS / Scarborough activity area are located at Barrow Island and the Montebello Islands. These areas are designated habitat critical for the stock and include an internesting buffer of 20 km radius around these rookeries, November to March.
Hawksbill Turtle	
Western Australia Stock (H-WA)	The H-WA stock is the largest in the Indian Ocean. The majority of the nesting for this stock is located in the Pilbara. The Dampier Archipelago has the largest nesting aggregation recorded. In particular, Rosemary Island supports the most significant hawksbill turtle rookery in the WA region and one of the largest in the Indian Ocean; approximately 500-1000 females nest on the island annually, more than at any other WA rookery (Pendoley, 2005; Pendoley *et al.*, 2016). Major rookeries of the H-WA stock within the NWS / Scarborough activity area are located at Rosemary Island, Delambre Island and the Montebello Islands. These areas are designated habitat critical for the stock and include an internesting buffer of 20 km radius around these rookeries, October to February.
Flatback Turtle	
South-west Kimberley Stock (F-swKim)	The genetic relationship between this nesting aggregation and the Cape Domett and Pilbara stocks is currently under review. Population numbers of the F-swKim stock are unknown. Major rookeries of the F-swKim stock are located at Eighty Mile Beach and Eco Beach. These areas are designated habitat critical for the stock and include an internesting buffer of 60 km radius around these rookeries, October to March.

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Species / Genetic Stock	Key Information
Pilbara Stock (F-Pil)	The extent of genetic relatedness of flatback turtles along the WA coast is currently under review. Population numbers of the F-Pil stock are unknown. This stock nests on many islands in the Pilbara and southern Kimberley, with major rookeries at Mundabullangana Beach, Delambre Island and Barrow Island. These areas are designated habitat critical for the F-Pil stock and include an internesting buffer of 60 km radius around these rookeries, October to March. Extending further than the habitat critical internesting buffer, a year-round internesting buffer BIA of 80 km is located north and north-west of the Montebello Islands. However, use level for this BIA has been defined as very low (Commonwealth of Australia, 2017) and the habitat critical internesting buffer is the legally recognised area of protection under the EPBC Act *Significant Impact Guidelines 1.1 – Matters of National Environmental Significance*. Post-nesting satellite tracking indicates foraging occurs along the WA coast in water shallower than 130 m and within 315 km of shore (Commonwealth of Australia, 2017).

6.4.3 North-west Cape

The North-west Cape activity area includes major nesting areas that support globally significant breeding populations of two marine turtle species, representing two discreet genetic stocks:

- the green turtle, NWS genetic stock; and
- the loggerhead turtle, Western Australia genetic stock.

Locations of habitat critical for each of the two species are outlined in **Table 6-2** and **Figure 6-2**.

BIAs for the green and loggerhead turtles are outlined in **Table 6-3** and **Figure 6-3**.

A 2018 survey, including on-beach monitoring of the Muiron Islands and Ningaloo Coast from North-west Cape to Bungelup (Rob *et al.*, 2019), supports the concept that North-west Cape and the Muiron Islands are major important nesting areas for green and loggerhead turtles, as identified in the Recovery Plan (Commonwealth of Australia, 2017).

Table 6-6 Marine turtle key information for North-west Cape activity area

Species / Genetic Stock	Key Information
Green Turtle	
NWS Stock (G-NWS)	The G-NWS stock is one of the largest green turtle stocks in the world and the largest in the Indian Ocean. The G-NWS stock is estimated at approximately 20,000 individuals (DSEWPAC, 2012a) and the trend for the stock is reported as stable (Commonwealth of Australia, 2017). There is one major rookery of the G-NWS stock located within the North-west Cape activity area. Located on the mainland coast of the North-west Cape, this area is designated habitat critical for the stock and includes an internesting buffer of 20 km radius around the rookery, November to March.
Loggerhead Turtle	
Western Australia Stock (LH-WA)	The LH-WA stock is one of the largest in the world (Limpus, 2009). The trend for the stock is reported as stable (Commonwealth of Australia, 2017). Major rookeries of the LH-WA stock are located at Dirk Hartog Island, Muiron Islands and Gnaraloo Bay. These areas are designated habitat critical for the stock and include an internesting buffer of 20 km radius around these rookeries, November to May. Dirk Hartog Island in the Shark Bay Marine Park, with an average of 122 nests per day over 2.1 km (Reinhold and Whiting, 2014), is recognised as the most important loggerhead turtle rookery in WA (Commonwealth of Australia, 2016; as cited in Rob *et al.*, 2019).

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6.5 Sea Snakes

Sea snakes are commonly found in the NWMR and NMR, but less so in the SWMR, and occupy three broad habitat types: shallow water coral reef and seagrass habitats, deepwater soft bottom habitats away from reefs, and surface water pelagic habitats (Guinea, 2007a).

There are 25 listed species of sea snake reported within or adjacent to the NWMR (Guinea, 2007a; Udyawer *et al*., 2016), of which four are endemic to reef habitats in the remote parts of the region:

- dusky sea snake (*Aipysurus fuscus*);
- large headed sea snake (*Hydrophis pacificus*);
- short-nosed sea snake (*Aipysurus apraefrontalis*); and
- leaf-scaled sea snake (*Aipysurus foliosquama*).

The short-nosed sea snake and the leaf-scaled sea snake are listed threatened species (Critically Endangered) under the EPBC Act **(Table 6-7**).

There is currently limited knowledge about the ranges and distribution patterns of sea snake species in the NWMR, in addition to a lack of understanding of population status and threats. Recent findings of *A. apraefrontalis* and *A. foliosquama* in locations outside of their previously defined ranges have highlighted the lack of information on species distributions in the NWMR (Udyawer *et al.*, 2016). Udyawer *et al.* (2020) used a correlative modelling approach to understand habitat associations and identify suitable habitats for five sea snake species (*A. apraefrontalis, A. foliosquama, A. fuscus, A. l. pooleorum* and *A. tenuis*). Species-specific habitat suitability was modelled across 804,244 km^2 of coastal waters along the NWS, and the resulting habitat suitability maps enabled the identification of key locations of suitable habitat for these five species (refer **Table 6-6**).

No habitat critical to survival or BIAs for sea snake species have been identified in the NWMR. While the Ashmore Reef and Cartier Island AMPs have been recognised for their high diversity and density of sea snakes (DSEWPAC, 2012a), surveys have revealed a steep decline in sea snake numbers at Ashmore Reef (Guinea, 2007b; Lukoschek *et al.*, 2013). Leaf-scaled and short-nosed sea snakes have been absent from surveys at Ashmore Reef since 2001, despite an increase in survey intensity (Guinea, 2006, 2007b; Guinea and Whiting, 2005; Lukoschek *et al.*, 2013). The reason for the decline is unknown.

Table 6-7 Information on the two threatened sea snake species within the NWMR

Species	Preferred Habitat and Diet	Habitat Location
Short-nosed sea snake	Preferred habitat: Primarily on the reef flats or in shallow waters of the outer reef edges to depths of 10 m (Minton *et al*., 1975). Typically, movement is restricted to within 50 m of reef flat habitat (Guinea and Whiting, 2005). Diet: Primarily fishes and eels.	The short-nosed sea snake has been recorded from Exmouth Gulf to the reefs of the Sahul Shelf, although most records come from Ashmore and Hibernia reefs (Guinea and Whiting, 2005). Key locations of suitable habitat: Ashmore Reef, Exmouth Gulf, Muiron Islands, Montebello Islands (Udyawer *et al.*, 2020).
Leaf-scaled sea snake	Preferred habitat: The leaf-scaled sea snake occurs in shallow protected areas of reef flats, typically in water depth less than 10 m. Diet: Primarily shallow water coral-associated wrasse, gudgeons, clinids and eels (McCosker, 1975; Voris, 1972; Voris and Voris, 1983)	The leaf-scaled sea snake has only been recorded at Ashmore and Hibernia reefs (Guinea and Whiting, 2005), indicating it has a very limited distribution. Key locations of suitable habitat: Ashmore Reef, Shark Bay, Exmouth Gulf, Barrow Island and Montebello Islands (Udyawer *et al.*, 2020).

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6.6 Crocodiles

The salt-water crocodile (*Crocodylus porosus*) is a listed migratory species under the EPBC Act known to occur within the NWMR. The species is found in most major river systems of the Kimberley, including the Ord, Patrick, Forrest, Durack, King, Pentecost, Prince Regent, Lawley, Mitchell, Hunter, Roe and Glenelg rivers. The largest populations occur in the rivers draining into the Cambridge Gulf and the Prince Regent River and Roe River systems. There have also been isolated records in rivers of the Pilbara region, around Derby near Broome and as far south as Carnarvon on the mid-west coast.

No BIAs for salt-water crocodile have been identified in the NWMR.

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7. MARINE MAMMALS

7.1 Regional Context

The offshore waters of WA include important habitat for marine mammals, including areas that support key life stages such as breeding, foraging, and migration. Of the 45 species of cetacean occurring in Australian waters, 27 species occur regularly in the waters of the NWMR, nine species in the waters of the NMR and 33 species in the SWMR. The waters of the NWMR and the NMR also support significant populations of dugong (DSEWPAC, 2012a, c).

The NWMR is an important migratory pathway between feeding grounds in the Southern Ocean and breeding grounds in tropical waters of the NWMR for several cetacean species (DSEWPAC, 2012a). Numerous large mysticetes (baleen whale) species, in particular the humpback whale, are known to utilise the region for migration and calving, and the pygmy blue whale for foraging and as a migration pathway between southern feeding and northern breeding/feeding areas, north of the equator.

The SWMR is an important area for numerous marine mammal species including pinniped species, large, migratory whale species and resident coastal whale and dolphin species (DSEWPAC, 2012b).

The NMR and adjacent areas are important for several species of cetacean, particularly inshore dolphin species. These species, and other marine mammals, rely on the waters of the NMR and adjacent coastal areas for breeding and foraging. However, there is little knowledge of the seasonal movements, migrations and breeding seasonality for many of the marine mammal species in the NMR due to lack of extensive surveys (DSEWPAC, 2012c).

Table 7-1 outlines the threatened and migratory marine mammal species that may occur within the NWMR, with their conservation status and relevant recovery plans and/or conservation advice.

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Table 7-1 Marine mammal species identified by the EPBC Act PMST as occurring within the NWMR

Species Name	Common Name	*Environment Protection and Biodiversity Conservation Act 1999*			WA *Biodiversity Conservation Act 2016*	EPBC Act Part 13 Statutory Instrument
		Threatened Status	Migratory Status	Listed	Conservation Status	
Cetaceans - Mysticeti						
Balaenoptera musculus	Blue whale	Endangered	Migratory	Cetacean	Endangered	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)
Eubalaena australis	Southern right whale	Endangered	Migratory	Cetacean	Vulnerable	Conservation Management Plan for the Southern Right Whale: A Recovery Plan under the *Environment Protection and Biodiversity Conservation Act 1999* 2011-2021 (DSEWPAC, 2012d)
Balaenoptera borealis	Sei whale	Vulnerable	Migratory	Cetacean	Endangered	Conservation Advice *Balaenoptera borealis* sei whale (Threatened Species Scientific Committee, 2015a)
Megaptera novaeangliae	Humpback whale	Vulnerable	Migratory	Cetacean	Conservation dependent	Conservation Advice *Megaptera novaeangliae* humpback whale (Threatened Species Scientific Committee, 2015b)
Balaenoptera physalus	Fin whale	Vulnerable	Migratory	Cetacean	Endangered	Conservation Advice *Balaenoptera physalus* fin whale (Threatened Species Scientific Committee, 2015c)
Balaenoptera edeni	Bryde's whale	N/A	Migratory	Cetacean	N/A	N/A
Balaenoptera bonaerensis	Antarctic minke whale	N/A	Migratory	Cetacean	N/A	N/A
Cetaceans - Odontoceti						
Physeter macrocephalus	Sperm whale	N/A	Migratory	Cetacean	Vulnerable	N/A
Orcinus orca	Killer whale	N/A	Migratory	Cetacean	N/A	N/A
Orcaella heinsohni	Australian snubfin dolphin	N/A	Migratory	Cetacean	Priority	N/A
Sousa chinensis	Indo-Pacific humpback dolphin	N/A	Migratory	Cetacean	Priority	N/A

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Species Name	**Common Name**	***Environment Protection and Biodiversity Conservation Act 1999***			**WA *Biodiversity Conservation Act 2016***	**EPBC Act Part 13 Statutory Instrument**
		Threatened Status	**Migratory Status**	**Listed**	**Conservation Status**	
Tursiops aduncus	Spotted bottlenose dolphin (Arafura/Timor Sea populations)	N/A	Migratory	Cetacean	N/A	N/A
Sirenians and Pinnipeds						
Dugong dugon	Dugong	N/A	Migratory	Marine	Other protected fauna	N/A
Neophoca cinerea	Australian sea lion	Endangered	N/A	Marine	Vulnerable	Recovery Plan for the Australian Sea Lion (*Neophoca cinerea*) 2013 (DSEWPAC, 2013a) Conservation Advice *Neophoca cinerea* Australian Sea Lion (Threatened Species Scientific Committee, 2020a) (in effect under the EPBC Act from 23-Dec-2020)

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7.2 Cetaceans in the NWMR

Cetaceans are generally widely distributed and highly mobile. In general, distribution patterns reflect seasonal feeding areas, characterised by high productivity, and migration routes associated with reproductive patterns. The NWMR is thought to be an important migratory pathway between feeding grounds in the Southern Ocean and breeding grounds in tropical waters for several cetacean species (DSEWPAC, 2012a).

From the Protected Matters search, 34 EPBC Act listed species were recorded as potentially occurring or having habitat within the NWMR (**Appendix A**). Of those, 12 cetacean species are listed as threatened and/or migratory, including baleen whales, toothed whales and dolphins that occur within the NWMR (**Table 7-2**).

7.3 Dugongs in the NWMR

The dugong is listed as migratory under the EPBC Act. Dugongs inhabit seagrass meadows in coastal waters, estuarine creeks and streams, and reef systems (DSEWPAC, 2012a).

Some of the coastal waters adjacent to the NWMR support significant populations of dugongs, including Shark Bay, Exmouth Gulf, in and adjacent to Ningaloo Reef, in coastal waters along the Kimberley coast, and on the edge of the continental shelf at Ashmore Reef (DEWHA, 2008).

Although the patterns of dugong movement in WA are not well understood, it is thought that dugongs move in response to availability of seagrass (Marsh *et al.*, 1994; Preen *et al.*, 1997) and water temperature.

There are a number of BIAs for dugong within and adjacent to waters of the NWMR (refer **Section 7.5**).

7.4 Pinnipeds in the NWMR

The Australian sea lion is listed as a species that may occur, or may have habitat within the NWMR (Protected Matters search - **Appendix A**). It is included here as the Australian sea lion is the only pinniped endemic to Australia (Strahan, 1983) and has been recorded within the southern extent of the NWMR at Shark Bay, WA (Kirkwood *et al.*, 1992). The most northern known breeding colony is at the Houtman Abrolhos Islands in the SWMR. The Australian sea lion's breeding range extends from the Houtman Abrolhos Islands, WA to The Pages Island, east of Kangaroo Island, SA. The Australian sea lion was listed as endangered in 2020 (Threatened Species Scientific Committee, 2020a). An assessment of the status and trends in abundance of this endemic, coastal pinniped species (Goldsworthy *et al.* 2021) documented an overall reduction in pup abundance over three generations, providing strong evidence that the species meets IUCN endangered criteria.

There are no BIAs for the Australian sea lion in the NWMR.

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Table 7-2 Information on the threatened/migratory marine mammal species within the NWMR

Species	Key Information
	Baleen whales (Mysticeti)
Humpback whale	In Australian waters two genetically distinct populations migrate annually along the west (Group IV) and east coasts (Group V) between May and November. In WA, the migration pathway for the Group IV population (also known as Breeding Stock D) extends from Albany to the Kimberley coastline, passing through the NWMR (Threatened Species Scientific Committee, 2015b). Since the 1982 moratorium on commercial whaling population numbers have recovered significantly; from approximately 2000 to 3000 individuals in 1991, to between 19,200–33,850 individuals in 2008 (Bannister and Hedley, 2001; Bejder *et al.*, 2019; Hedley *et al.*, 2011). Aerial surveys off the WA coast undertaken between 2000 and 2008 produced a population estimate for the Group IV population of 26,100 individuals (CI 20,152–33,272) in 2008 (Salgado Kent *et al.*, 2012). Current population growth for the Group IV population is estimated to be between 9.7 and 13% per annum (Threatened Species Scientific Committee, 2015b). Using the Salago-Kent *et al.* (2012) estimate of 26,100 individuals and an annual population growth rate of ~10%, current population size could be in excess of 75,000 individuals (Woodside, 2019). The Group IV population migrates northward from their Antarctic feeding grounds around May each year, reaching the NWMR around early June. The southward migration subsequently starts in mid-September, around the time of breeding and calving (typically August to September) (Threatened Species Scientific Committee, 2015b). Within the NWMR there are key calving areas between Broome and the northern end of Camden Sound, and resting areas in the southern Kimberley region, Exmouth Gulf and Shark Bay. In particular, high numbers of humpback whales are observed in Camden Sound and Pender Bay from June to September each year (Threatened Species Scientific Committee, 2015b). There are reports of neonates further south, suggesting that the calving areas may be poorly defined. Aerial photogrammetric surveys in 2013 and 2015 recorded large numbers of humpback whale calves along North-west Cape, with estimated minimum relative calf abundance of 463–603 in 2013 and 557–725 in 2015 (Irvine *et al.*, 2018). The majority of calves sighted in both years (85% in 2013; 94% in 2015) were neonates, and these observations indicate that a minimum of approximately 20% of the expected number of calves of this population are born near, or south of, North-west Cape. Thus, the calving grounds for the Group IV population extend south from Camden Sound to at least North-west Cape, 1000 km south-west of the currently recognized calving area (Irvine *et al.*, 2018). There are BIAs for migration and breeding and calving for the humpback whale along the WA coast and within the NWMR (refer **Table 7-3** and **Figure 7-1**).
Blue whale	There are two recognised sub-species of blue whale in the Southern Hemisphere, both of which are recorded in Australian waters. These are the southern (or 'true') blue whale (*Balaenoptera musculus*) and the 'pygmy' blue whale (*Balaenoptera musculus brevicauda*) (Commonwealth of Australia, 2015a). 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). On this basis, nearly all blue whales sighted in the NWMR are likely to be pygmy blue whales. The East Indian Ocean (EIO) pygmy blue whale population is seasonally distributed from Indonesia (a potential breeding ground) to south-west of Australia and east across the Great Australian Bight and Bonney Upwelling to beyond the Bass Strait (Blue Planet Marine, 2020). Migration seems to be variable, with some individuals appearing as resident to areas of high productivity and others undertaking migrations across long distances (Commonwealth of Australia, 2015a). McCauley *et al.* (2018) describe three migratory stages around Australia for the EIO pygmy blue whale population: a 'southbound migratory stage' where whales travel southwards from Indonesian waters offshore from the WA coastline, mostly from October to December but possibly into January of the following year; a protracted 'southern Australian stage' (January to June) where animals spread across southern waters of the Indian Ocean and south of Australia; and a 'northbound migratory stage' (April to August) where animals travel north back to Indonesia again. There are currently insufficient data to accurately estimate population numbers of the pygmy blue whale in Australian waters (Blue Planet Marine, 2020; Commonwealth of Australia, 2015a). There are, however, two estimates of population size of the EIO pygmy blue whale for WA. McCauley and Jenner (2010) calculated the population to be between 662 and 1559 individuals in 2004 based on passive acoustics (whale vocalisations), and Jenner *et al.* (2008) (based on photographic mark and recapture) calculated between 712 and 1754 individuals, but both estimates did not account for animals

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Species	Key Information
	travelling further west into the Indian Ocean (McCauley *et al.*, 2018). More recent passive acoustic data estimates a 4.3% growth rate that applies to the proportion of EIO pygmy blue whales seasonally present in offshore water of the south-eastern Australia and may not reflect the full population but does imply an increasing population (McCauley *et al.*, 2018). The pygmy blue whale is typically present in the Perth Canyon from November to June, with an observed peak between March and May (Commonwealth of Australia, 2015a; Blue Planet Marine, 2020). The pygmy blue whale feeds in the Perth Canyon at depths of 200 to 300 m, which overlaps the typical distribution of krill (200–500 m water depth (day) to surface (night) (McCauley *et al.*, 2004; Commonwealth of Australia, 2015a). Other possible feeding grounds off the WA coast include the wider area around the Perth Canyon, and possible foraging areas off the Ningaloo Coast and at Scott Reef (Commonwealth of Australia, 2015a). Refer **Table 7-3** and **Figure 7-2** for the location and type of BIAs for blue whales in the NWMR. There is a migratory BIA for the pygmy blue whale within WA waters, which extends for most of the length of the NWMR within offshore waters.
Bryde's whale	The Bryde's whale is the least migratory of its genus and is restricted geographically from the equator to approximately 40°N and S, or the 20° isotherm (Bannister *et al.*, 1996). The species is known to exhibit inshore and offshore forms in other international locations that vary in morphology and migratory behaviours (Bannister *et al.*, 1996). This appears to also be the case within Australian waters. Bryde's whales have been identified as occurring in both oceanic and inshore waters, with the only key localities recognised in WA being in the Houtman Abrolhos Islands and north of Shark Bay (Bannister *et al.*, 1996). Data suggests offshore whales migrate seasonally, heading towards warmer tropical waters during the winter; however, information about migration within the NWMR is not well known (McCauley and Duncan, 2011). McCauley (2011) detected Bryde's whales using acoustic loggers deployed in and around Scott Reef from 2006 to 2009. Other acoustic logger data of Bryde's whale vocalisations recorded between Ningaloo and north of Darwin showed no apparent trends or seasonality (McCauley, 2011). There are no identified BIAs for this species in the National Conservation Values Atlas.
Southern right whale	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 outside of the NWMR. However, there have been sightings in waters of the NWMR as far north as Ningaloo (Bannister and Hedley, 2001), and a stranding record exists for the far north Kimberley coast (ALA, 2020). Southern right whale calving grounds are found at mid to lower latitudes and are occupied during the austral winter and early-mid spring. They are regularly present on the southern Australian coast from about mid-May to mid-November, and peak periods for mating are from mid-July through August. Mating occurs within these breeding grounds as evidenced by many observations of intromission and mating behaviours. Southern right whales in south-western Australia appear to be increasing at the maximum biological rate but there is limited evidence of increase in south-eastern Australian waters (DSEWPAC, 2012d). There are no identified BIAs for this species in the NWMR.
Antarctic minke whale	The Antarctic minke whale is distributed worldwide and has been recorded off all Australian states (but not in the NT), 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 about timing and location of migrations and breeding grounds within the NWMR is not well known. In the high latitudinal winter breeding grounds in other regions, the species appears to be distributed off the continental shelf edge. No population estimates are available for Antarctic minke whales in Australian waters. There are no identified BIAs for this species in the National Conservation Values Atlas.
Sei whale	The sei whale is a baleen whale with 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). There are no known mating or calving areas in Australian waters. The species has a preference for deep waters, typically occurs in oceanic basins and continental slopes (Prieto *et al.*, 2012), and exhibits a migration pathway influenced by seasonal feeding and breeding patterns. Sei whales have been infrequently recorded in Australian waters (Bannister *et al.*, 1996). Reliable estimates of the sei whale population size in Australian waters are currently not possible due to a lack of dedicated surveys and their elusive characteristics. Similarly, the extent of occurrence and area of occupancy of sei whales in Australian waters cannot be calculated due to the

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Species	Key Information
	rarity of sighting records. They will typically travel in small pods of three to five individuals, with some segregation by age, sex and reproductive status. Calving grounds are presumed to exist in low latitudes with mating and calving potentially occurring during winter months (Threatened Species Scientific Committee, 2015a). There are no known mating or calving areas in Australian waters, and there are no identified BIAs for this species in the National Conservation Values Atlas.
Fin whale	The fin whale is a large baleen whale distributed worldwide. Fin whales migrate annually between high latitude summer feeding grounds and lower latitude over-wintering areas (Bannister *et al.*, 1996) and follow oceanic migration paths. The species is uncommonly encountered in coastal or continental shelf waters. 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). The species has been observed in groups of six to 10 individuals, as well as in pairs and alone (Threatened Species Scientific Committee, 2015c). Accurate distribution patterns are not known within Australian waters and the majority of data are from stranding events. Fin whales have been recorded vocalising off the Perth Canyon, WA, between January and April 2000 (McCauley *et al.*, 2000). It is currently not possible to accurately estimate the population size of fin whales in Australian waters predominantly due to the species' behaviour and local ecology, as the proportion of time they spend at the surface varies greatly depending on these factors. In addition, natural fluctuations of fin whales in Australian waters are unknown; however, long-range movements do appear to be prey-related. A recent study by Aulich *et al.* (2019) used passive acoustic monitoring as a tool to identify the migratory movements of fin whales in Australian waters. On the west coast, the earliest arrival of these animals occurred at Cape Leeuwin in April, and between May and October they migrated along the WA coastline to the Perth Canyon, which likely acts as a way-station for feeding (Aulich *et al.*, 2019). Some whales were found to continue migrating as far north as Dampier (Aulich *et al.*, 2019). There are no identified BIAs for this species in the National Conservation Values Atlas.
Toothed whales (Odontoceti)	
Sperm whale	Sperm whales are the largest of the toothed whales and are distributed worldwide in deep waters (greater than 200 m) off continental shelves and sometimes near shelf edges (Bannister *et al.*, 1996). The species tends to inhabit offshore areas at depths of 600 m or more and is uncommon in waters less than 300 m deep (Ceccarelli *et al.*, 2011). 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. In the open ocean, there is a generalised movement of sperm whales southwards in summer, and corresponding movement northwards in winter, particularly for males. 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, 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 and appear to occasionally venture into shallower waters in other areas. Twenty-three (23) 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 (December 2016 to April 2017) (Woodside, 2020). These animals were observed in deep, continental slope waters of the Montebello Saddle (maximum distance of approximately 90 km from North-west Cape), and the waters overlying the Canyons linking the Cuvier Abyssal Plain and the Cape Range Peninsula KEF. The deep waters above the gully/saddle on the inner edge of the plateau (the Montebello Saddle) are thought to be important for sperm whales that may feed in the region (based on 19th Century whaling records; Townsend, 1935). There are no identified BIAs for this species in the NWMR.
Killer whale	The preferred habitat of killer whales includes oceanic, pelagic and neritic (relatively shallow waters over the continental shelf) regions, in both warm and cold waters. Killer whales appear to be more common in cold, deep waters; however, they have been observed along the continental slope and shelf, particularly near seal colonies, as well as in shallow coastal areas of WA (Bannister *et al.*, 1996; Thiele and Gill, 1999). The total number of killer whales in Australian waters is unknown, however, it may be that the total number of mature animals within waters around the continent is less than 10,000. Killer whales are known to make seasonal movements, and probably follow regular migratory routes, but no information is available for the

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Species	Key Information
	species in Australian waters. Killer whales are top-level carnivores, and there are reports from around Australia of attacks on dolphins, juvenile humpback whales, blue whales, sperm whales, dugongs and Australian sea lions (Bannister *et al.*, 1996). Killer whales are known to target humpback whales, particularly calves, off Ningaloo Reef during the humpback southern migration season (Pitman *et al.*, 2015). Overall, observations suggest that humpback calves are a predictable, plentiful, and readily taken prey source for killer whales off Ningaloo Reef for at least five months of the year. Additionally, there are records of killer whales attacking dugongs in Shark Bay (Anderson and Prince, 1985). However, there are no recognised key localities or important habitats for killer whales within the NWMR (DSEWPAC, 2012a). There are no identified BIAs for this species in the NWMR.
Australian snubfin dolphin	Stranding and museum specimen records indicate that Australian snubfin dolphins occur only in waters off northern Australia, from approximately Broome on the west coast to the Brisbane River on the east coast (Parra *et al.*, 2002). Aerial and boat-based surveys indicate that Australian snubfin dolphins occur mostly in protected shallow waters close to the coast, and close to river and creek mouths (Parra, 2006; Parra *et al.*, 2006; Parra *et al.*, 2002). Within the NWMR, species has been found in the shallow coastal waters and estuaries along the Kimberley coast. Beagle and Pender bays on the Dampier Peninsula, and tidal creeks around Yampi Sound and between Kuri Bay and Cape Londonderry are important areas for Australian snubfin dolphins (DEWHA, 2008). Roebuck Bay has generally been considered the south-western limit of snubfin dolphin distribution across northern Australia, but the species has been recorded in Port Hedland harbour, the Dampier Archipelago, Montebello Islands, Exmouth Gulf and off North-west Cape (Allen *et al.*, 2012). A first comprehensive catalogue of snubfin dolphin sightings has been compiled for the Kimberley, north-west Western Australia (Bouchet *et al.* 2021) and documented that snubfin dolphins are consistently encountered in shallow water (<21 m depth) close to (<15 km) freshwater inputs with high detection rates in known hotspots such as Roebuck Bay and Cygnet Bay as well as suitable coastal habitat in the wider Kimberley region. Refer **Table 7-3** and **Figure 7-3** for the location and type of BIAs for Australian snubfin dolphins in the NWMR.
Indo-Pacific humpback dolphin (Australian humpback dolphin)	Previously included with *Sousa chinensis*, the Australian humpback dolphin (*S. sahulensis*) was elevated to a species in 2014. *S. chinensis* is now applied for humpback dolphins in the eastern Indian and western Pacific Oceans and *S. sahulensis* for humpback dolphins in the waters of the Sahul Shelf from northern Australia to southern New Guinea (Jefferson and Rosenbaum, 2014). The Australian humpback dolphin is listed as *S. chinensis* under EPBC Act. The Australian humpback dolphin (referred to as 'humpback dolphin' hereafter) inhabits the tropical/subtropical waters of the Sahul Shelf across northern Australia and southern Papua New Guinea (Jefferson and Rosenbaum, 2014). Based on historical stranding data, museum specimens and opportunistic sightings collected during aerial and boat-based surveys for other fauna it has been inferred that humpback dolphins occur from the WA/NT border south-west to Shark Bay (Hanf *et al.*, 2016). Allen *et al.* (2012) suggested that humpback dolphins use a range of inshore habitats, including both clear and turbid coastal waters across northern WA. The waters surrounding North-west Cape are an important area for the species. Boat-based surveys up to 5 km out from the coast (Brown *et al.*, 2012) recorded humpback dolphins from 0.3 to 4.5 km away from shore and in depths ranging from 1.2 to 20 m, with a mean of ~8 m. Other studies around North-west Cape, surveying waters up to 5 km from the coast, recorded humpback dolphins in water depths of up to 40 m (Hanf *et al.*, 2016). Based on density, site fidelity and residence patterns, North-west Cape is clearly an important habitat toward the south-western limit of this species' range (Hunt *et al.*, 2017). Aerial surveys targeting dugongs over the western Pilbara have recorded humpback dolphins more than 60 km from the mainland in shallow shelf waters (i.e. <30 m deep) near Barrow Island and the western Lowendal Islands (Hanf, 2015). The species has also been recorded in fringing coral reef and shallow, sheltered sandy lagoons at the Montebello Islands (Raudino *et al.*, 2018). Over the past ten years a number of studies have focused on populations of humpback dolphins along the Kimberley coast, including Roebuck Bay, the Dampier Peninsula, Cone Bay, Yampi Sound, Prince Regent River and the Cambridge Gulf (Brown *et al.*, 2016). Refer Table **Table 7-3** and **Figure 7-4** for the location and type of BIAs for Indo-Pacific humpback dolphins in the NWMR.
Indo-Pacific bottlenose dolphin (Spotted bottlenose dolphin)	There are four known sub-populations of spotted bottlenose dolphins, of which the Arafura/Timor Sea populations were identified as potentially occurring within the NWMR. The species is restricted to inshore areas such as bays and estuaries, nearshore waters, open coast environments, and shallow offshore waters including coastal areas around oceanic islands, from Shark Bay to the western edge of the Gulf of Carpentaria. The species

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Species	Key Information
	forages in a range of habitats but is generally restricted to water depths of less than 200 m (DSEWPAC, 2012a). Important foraging/breeding areas include the shallow coastal waters and estuaries along the Kimberley coast and Roebuck Bay. Refer **Table 7-3** the location and type of BIAs for spotted bottlenose dolphins in the NWMR.
Sirenians	
Dugong	Dugongs are distributed along the WA coast throughout the Gascoyne, Pilbara and Kimberley. Specific areas supporting dugong populations include: Shark Bay; Ningaloo and Exmouth Gulf; the Pilbara coast (Exmouth Gulf to De Grey River [Marsh *et al.*, 2002]); and Eighty Mile Beach and the Kimberley coast, including Roebuck Bay (Brown *et al.*, 2014). Dugong distribution is correlated with the seagrass habitats upon which it feeds, although water temperature has also been correlated with dugong movements and distribution (Preen *et al.*, 1997; Preen, 2004). Dugongs are known to migrate between seagrass habitats (hundreds of kilometres) (Sheppard *et al.*, 2006), and in Shark Bay they exhibit seasonal movements as a behavioural thermoregulatory response to winter water temperatures (Holley *et al.*, 2006; Marsh *et al.*, 2011). Aerial surveys since the mid-1980s indicate that dugong populations are now stable at a regional scale in Shark Bay and in the Exmouth/Ningaloo Reef. Refer **Table 7-3** and **Figure 7-5** for the location and type of BIAs for dugong in the NWMR.
Pinnipeds	
Australian sea lion	The Australian sea lion is the only endemic pinniped (true seals, fur seals and sea lions) in Australian waters. It is a member of the Otariidae (eared seals) family. The birth interval in Australian sea lions is around 17–18 months. The Australian sea lion is unique among pinnipeds in being the only species that has a non-annual breeding cycle that is also temporally asynchronous across its range (DSEWPAC, 2013a; Threatened Species Scientific Committee, 2020a). This means the breeding period (copulation and birthing) in one colony will occur at different times to breeding in another colony. The Australian sea lion is considered to be a specialised benthic forager—that is, it feeds primarily on the sea floor. Studies have shown that the species will eat a range of prey, including fish, cephalopods (squid, cuttlefish and octopus), sharks, rays, rock lobsters and penguins (DSEWPAC, 2013a; Threatened Species Scientific Committee, 2020a). The Australian sea lion feeds on the continental shelf, most commonly in depths of 20–100 m, and they typically travel up to about 60 km from their colony on each foraging trip, with a maximum distance of around 190 km when over shelf waters. The current breeding distribution of the Australian sea lion extends from the Houtman Abrolhos Islands on the west coast of WA to the Pages Islands in SA. Sites for the 58 breeding colonies occurring in WA and SA are designated as habitat critical to the survival of the species under the Recovery Plan for the Australian sea lion (DSEWPAC, 2013a). Of these, four are located in the SWMR along the west coast of WA: Abrolhos Islands (Easter Group), Beagle Island, North Fisherman Island and Buller Island. There are also a number of foraging BIAs for both males and females along the west coast, extending from the Abrolhos Islands south to Rockingham. There is no designated habitat critical to survival or identified BIAs for this species in the NWMR. **Figure 7-6** shows the foraging BIAs for the Australian sea lion to the south of the NWMR.

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7.5 Biological Important Areas in the NWMR

BIAs representing important life cycle stages and behaviours for six species of marine mammal in the NWMR: the humpback whale, the pygmy blue whale, Australian snubfin dolphin, Australian humpback dolphin, spotted bottlenose dolphin and dugong, are presented in **Table 7-3**.

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Table 7-3 Marine mammal BIAs within the NWMR

Species	Woodside Activity Area			BIAs				
	Browse	NWS/S	NWC	Resting	Foraging	Breeding	Calving	Migration
Humpback whale[1]	✓	✓	✓	Shark Bay Exmouth Gulf (north migration – early June) (south migration – late Aug to Oct) Southern Kimberley region	No foraging BIA identified within the NWMR	Kimberley coast from the Lacepede Islands to north of Camden Sound (mid Aug – early Sept)	Core calving in waters off the Kimberley coast from the Lacepede Islands to north of Camden Sound (mid Aug – early Sept)	Southern border of the NWMR to north of the Kimberley (arrive June)
Blue whale and Pygmy blue whale [1] [2]	✓	✓	✓	No resting BIA identified within the NWMR	Possible foraging areas off Ningaloo and Scott Reef	No breeding BIA identified within the NWMR	No calving BIA identified within the NWMR	Augusta to Derby. Along the shelf edge at depths of 500 m to 1000 m; appear close to Ningaloo coast Montebello Islands area on southern migration (north: April – Aug) (south: Oct – late Dec)
Australian snubfin dolphin [1]	✓	✓	-	No resting BIA identified within the NWMR	Roebuck Bay Cambridge Gulf Camden Sound area King Sound (south) King Sound (north) Yampi Sound Talbot Bay Maret Islands Bigge Island Admiralty Gulf Parry Harbour Bougainville Peninsula Vansittart Bay Anjo Peninsula Napier	Roebuck Bay Cambridge Gulf Camden Sound area King Sound (south) King Sound (north) Yampi Sound Talbot Bay Maret Islands Bigge Island Admiralty Gulf Parry Harbour Bougainville Peninsula Vansittart Bay, Anjo Peninsula Napier Broome Bay Deep Bay Prince Regent River King George River Cape Londonderry	Roebuck Bay Cambridge Gulf Camden Sound area King Sound (south) King Sound (north) Yampi Sound Talbot Bay Maret Islands Bigge Island Admiralty Gulf Parry Harbour Bougainville Peninsula Vansittart Bay Anjo Peninsula Napier Broome Bay Deep Bay Prince Regent River	No migration BIA identified within the NWMR

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Species	Woodside Activity Area			BIAs				
	Browse	NWS/S	NWC	Resting	Foraging	Breeding	Calving	Migration
					Broome Bay Deep Bay Prince Regent River King George River Cape Londonderry Ord River	Ord River	King George River Cape Londonderry Ord River	
Indo-Pacific humpback dolphin	✓	✓	-	No resting BIA identified within the NWMR	Roebuck Bay Willie Creek Prince Regent River King Sound (north) Yampi Sound Talbot Bay Walcott Inlet Doubtful Bay Deception Bay Augustus Island Maret Islands Bigge Island King Sound, southern sector Vansittart Bay, Anjo Peninsula	Roebuck Bay Willie Creek Prince Regent River King Sound (north) Yampi Sound Talbot Bay Walcott Inlet Doubtful Bay Deception Bay Augustus Island	Roebuck Bay Willie Creek Prince Regent River	No migration BIA identified within the NWMR
Spotted bottlenose dolphin	✓	✓	✓	No resting BIA identified within the NWMR	Roebuck Bay Cambridge Gulf Camden Sound area King Sound (south) King Sound (north) Yampi Sound	Roebuck Bay Cambridge Gulf Camden Sound area King Sound (south) King Sound (north) Yampi Sound	No calving BIA identified within the NWMR	No migration BIA identified within the NWMR

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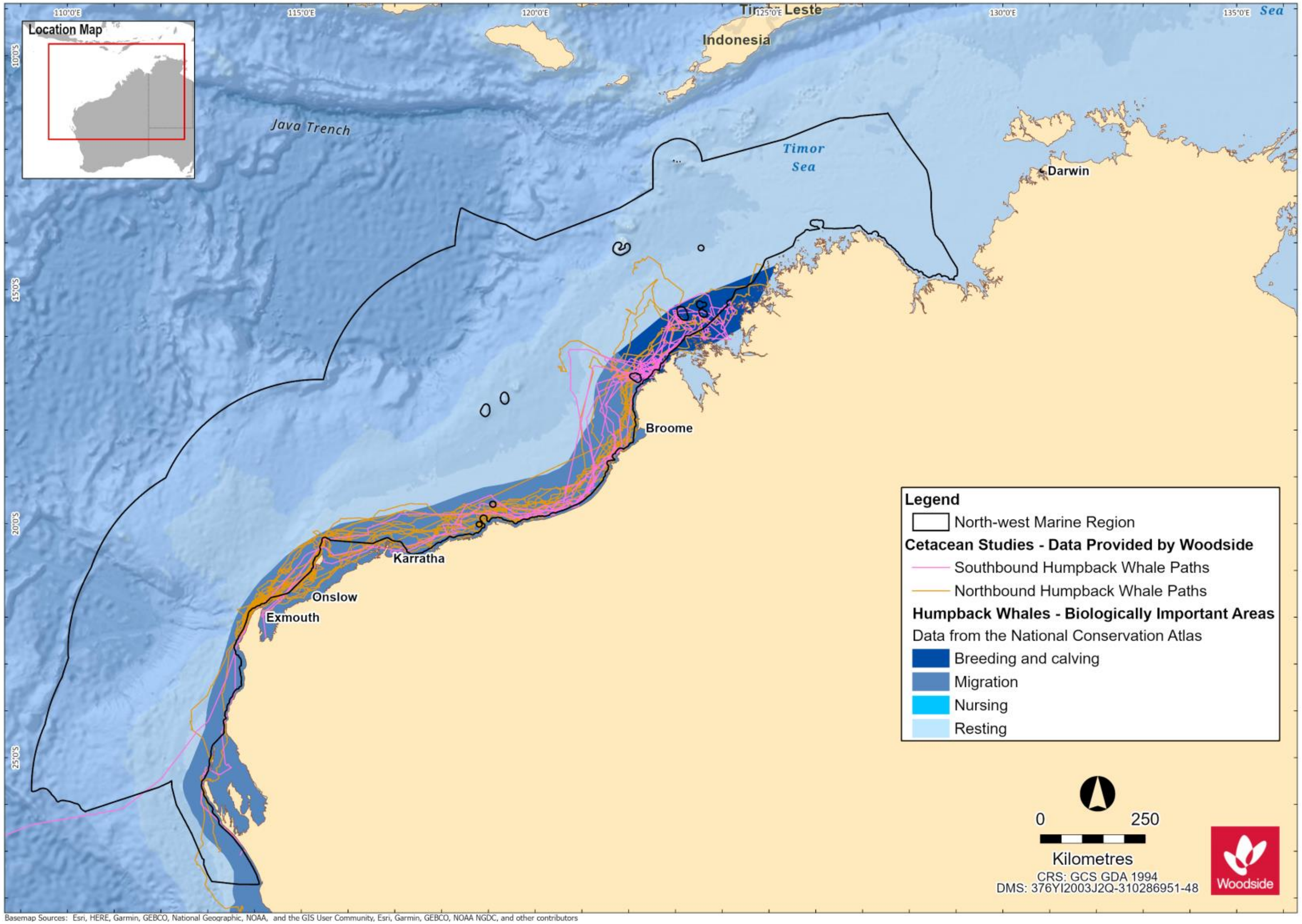
Species	Woodside Activity Area			BIAs				
	Browse	NWS/S	NWC	Resting	Foraging	Breeding	Calving	Migration
Dugong[1]	✓	✓	✓	No resting BIA identified within the NWMR	Exmouth Gulf Ningaloo Reef Shark Bay Roebuck Bay Dampier Peninsula	No breeding BIA identified within the NWMR	Exmouth Gulf Ningaloo Reef Shark Bay	Not listed as a migratory species

[1] *DSEWPAC (2012a)*

[2] *Commonwealth of Australia (2015a)*



Basemap Sources: Esri, HERE, Garmin, GEBCO, National Geographic, NOAA, and the GIS User Community, Esri, Garmin, GEBCO, NOAA NGDC, and other contributors

Figure 7-1 Humpback whale BIAs for the NWMR and tagged tracks for north and south bound migrations

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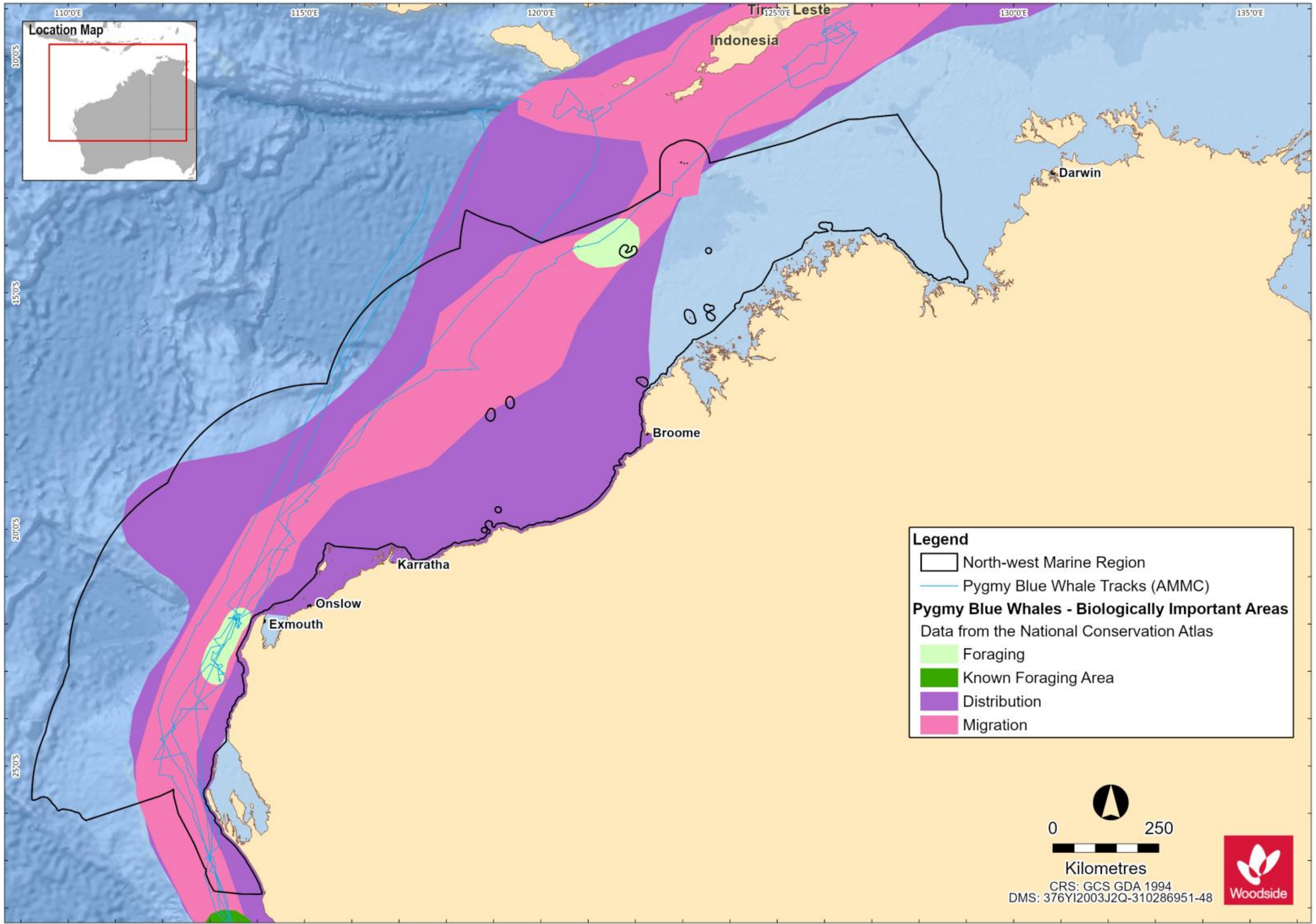

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Figure 7-2 Pygmy blue whale BIAs for the NWMR and tagged whale tracks for northbound migration

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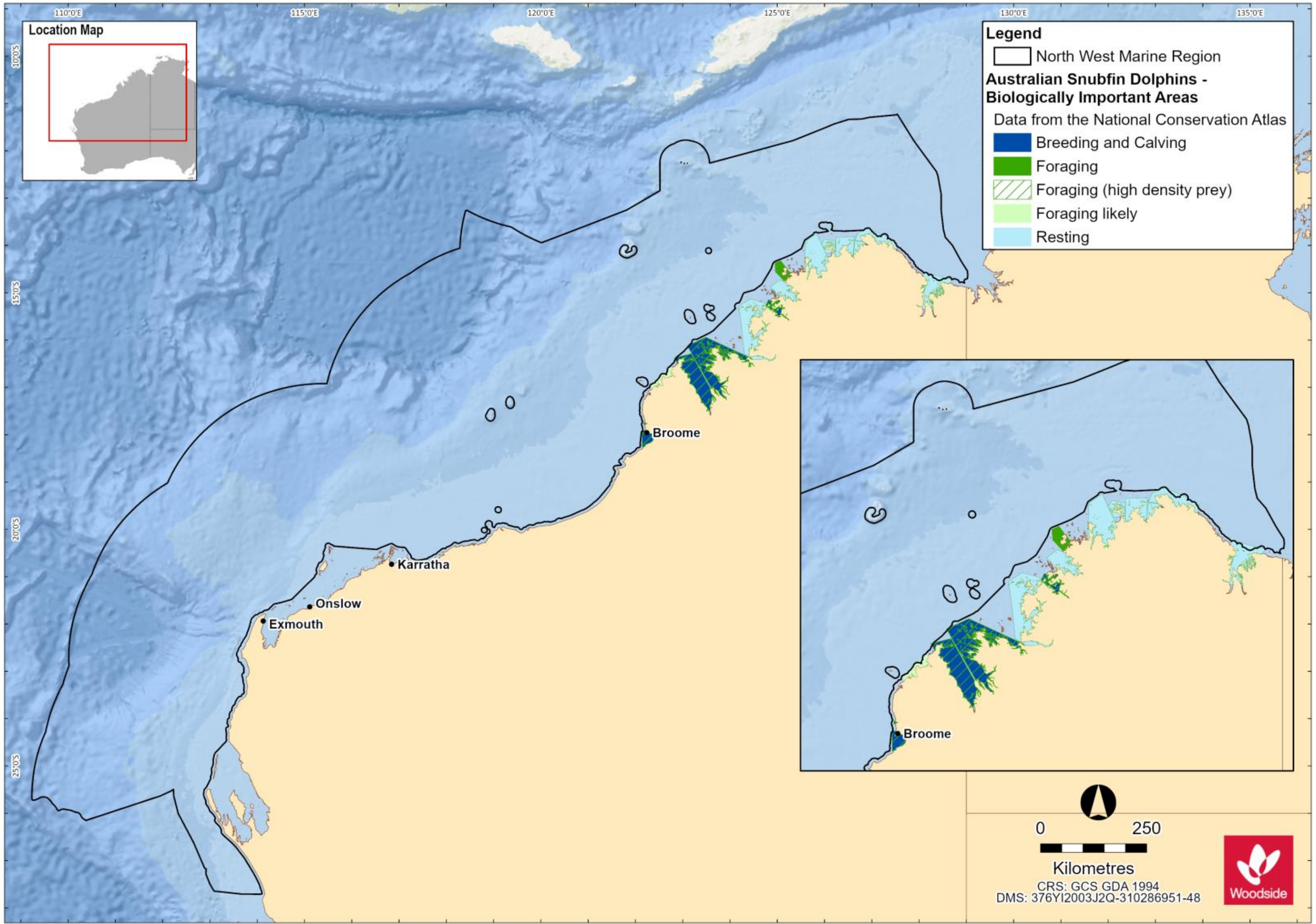

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Figure 7-3 Australian snubfin dolphin BIAs for the NWMR

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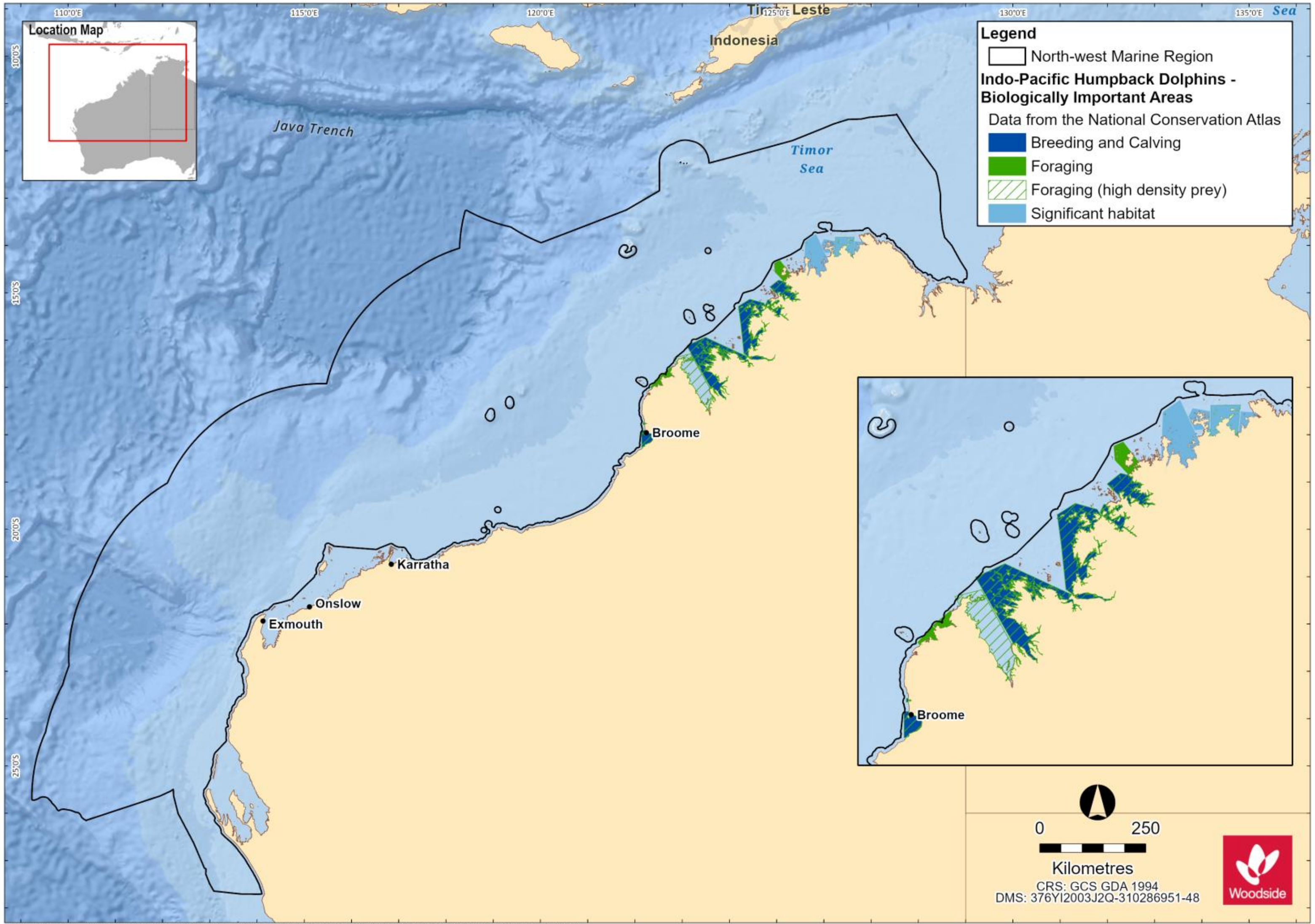
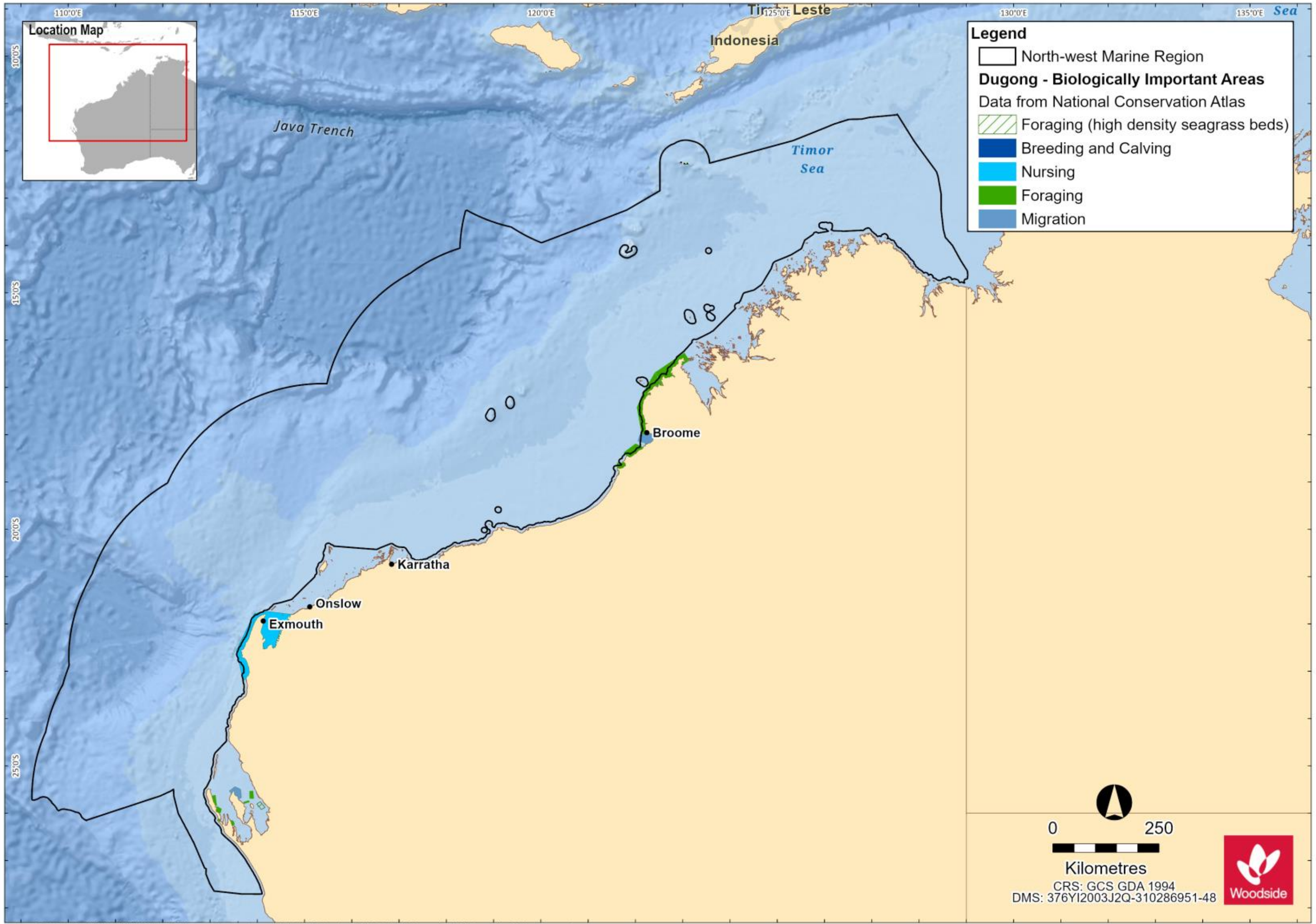


Basemap Esri, Garmin, GEBCO, NOAA NGDC, and other contributors, Sources: Esri, HERE, Garmin, GEBCO, National Geographic, NOAA, and the GIS User Community

Figure 7-4 Indo-Pacific humpback dolphin BIAs for the NWMR



Basemap Esri, Garmin, GEBCO, NOAA NGDC, and other contributors, Sources: Esri, HERE, Garmin, GEBCO, National Geographic, NOAA, and the GIS User Community

Figure 7-5 Dugong BIAs for the NWMR

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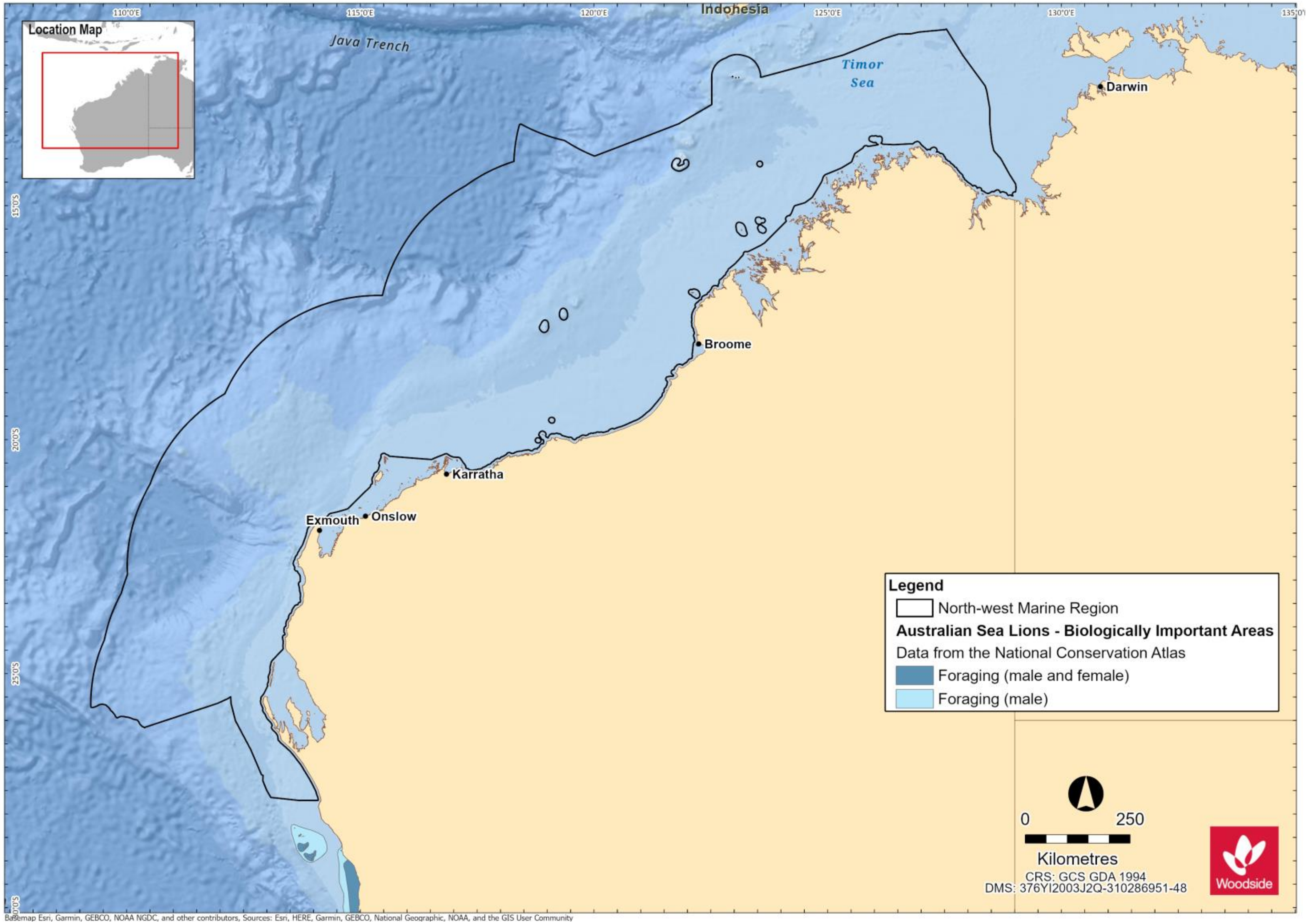

Basemap Esri, Garmin, GEBCO, NOAA NGDC, and other contributors, Sources: Esri, HERE, Garmin, GEBCO, National Geographic, NOAA, and the GIS User Community

Figure 7-6 Australian sea lion BIAs in the northern extent of the SWMR closest to the NWMR

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7.6 Marine Mammal Summary for the NWMR

7.6.1 Browse

The Browse activity area includes biologically important habitat for five threatened and/or migratory marine mammal species:

- blue whale and pygmy blue whale (foraging and migration areas);
- humpback whale (breeding, calving and migration areas);
- Indo-Pacific humpback dolphin (foraging, breeding and calving areas);
- Australian snubfin dolphin (foraging, breeding and calving areas); and
- dugong (foraging).

BIAs for the marine mammal species are outlined in **Table 7-3**.

7.6.2 North-west Shelf / Scarborough

The NWS / Scarborough activity area includes biologically important habitat for five threatened and/or migratory marine mammal species:

- blue whale and pygmy blue whale (foraging and migration areas);
- humpback whale (resting and migration areas);
- Indo-Pacific humpback dolphin (foraging, breeding and calving areas);
- Australian snubfin dolphin (foraging, breeding and calving areas); and
- dugong (foraging and calving areas).

BIAs for the marine mammal species are outlined in **Table 7-3**.

7.6.3 North-west Cape

The North-west Cape activity area includes biologically important habitat for three threatened and/or migratory marine mammal species:

- blue whale and pygmy blue whale (foraging and migration areas);
- humpback whale (resting and migration areas); and
- dugong (foraging and calving areas).

BIAs for the marine mammal species are outlined in **Table 7-3**.

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8. SEABIRDS AND MIGRATORY SHOREBIRDS OF THE NWMR

8.1 Regional Context

The NWMR supports high numbers and species diversity of seabirds and migratory shorebirds including many that are EPBC Act listed, threatened and migratory. The NWMR marine bioregional plan reported 34 seabird species (listed as threatened, migratory and/or marine) that are known to occur, and 30 of 37 species of migratory shorebird species that regularly occur in Australia, are recorded at Ashmore Reef in the NWMR (DSEWPAC, 2012e). The NWMR marine bioregional plan also noted that Roebuck Bay and Eighty Mile Beach are internationally significant and recognised migratory shorebird locations.

Many migratory seabirds and shorebirds are protected through bilateral agreements between Australia and Japan (JAMBA), China (CAMBA) and the Republic of Korea (ROKAMBA), recognising the migratory route and important stopover and resting habitats of the East Asian-Australasian Flyway (EAAF). Important migratory bird habitats are also recognised as part of protected wetlands of the internationally significance under the Ramsar Convention. Important Bird Areas (IBAs) for the NWMR, which are also recognised as global Key Biodiversity Areas (KBAs) (BirdLife Australia[4]), include:

- Roebuck Bay KBA (and Ramsar site): Internationally significant migratory shorebird species.
- Mandora Marsh and Anna Plains KBA (adjacent to Eighty Mile Beach, Ramsar site): Internationally significant migratory shorebird species.
- Dampier Saltworks KBA: Internationally significant migratory shorebird species.
- Montebello Islands KBA: Shorebird and seabird species.
- Barrow Island KBA: Shorebird and seabird species.
- Exmouth Gulf Mangroves KBA: Internationally significant migratory shorebird species.

Table 8-1 presents a list of the threatened and migratory seabird and shorebird species that occur within the NWMR, with their conservation status and relevant recovery plans and/or conservation advice.

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[4] https://www.birdlife.org.au/projects/KBA#:~:text=The%20Key%20Biodiversity%20Areas%20(KBAs,of%20advocacy%20for%20protected%20areas. Accessed April, 2021.

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Table 8-1. Bird species (threatened/migratory) identified by the EPBC Act PMST and other sources of information as potentially occurring within the NWMR

Species Name	Common Name	*Environment Protection and Biodiversity Conservation Act 1999*			WA *Biodiversity Conservation Act 2016*	EPBC Act Part 13 Statutory Instrument
		Threatened Status	Migratory Status	Listed	Conservation Status	
Seabirds						
Macronectes giganteus	Southern giant petrel	Endangered	Migratory	Marine	Migratory	National recovery plan for threatened albatrosses and giant petrels 2011-2016 (DSEWPAC, 2011c)
Papasula abbotti	Abbott's booby	Endangered	N/A	Marine	N/A	Conservation Advice for the Abbott's booby - *Papasula abbotti* (Threatened Species Scientific Committee, 2020b)
Pterodroma mollis	Soft-plumaged petrel	Vulnerable	N/A	Marine	N/A	Conservation Advice *Pterodroma mollis* soft-plumaged petrel (Threatened Species Scientific Committee, 2015f)
Sternula nereis nereis	Australian fairy tern	Vulnerable	N/A	N/A	Vulnerable	Conservation Advice for *Sternula nereis nereis* (Fairy Tern) (DSEWPAC, 2011d)
Anous tenuirostris melanops	Australian lesser noddy	Vulnerable	N/A	Marine	Endangered	Conservation Advice *Anous tenuirostris melanops* Australian lesser noddy (Threatened Species Scientific Committee, 2015e)
Thalassarche carteri	Indian yellow-nosed albatross	Vulnerable	Migratory	Marine	Endangered	National recovery plan for threatened albatrosses and giant petrels 2011-2016 (DSEWPAC, 2011c)
Anous stolidus	Common noddy	N/A	Migratory	Marine	Migratory	Draft Wildlife Conservation Plan for Seabirds (Commonwealth of Australia, 2019)
Fregata ariel	Lesser frigatebird	N/A	Migratory	Marine	Migratory	
Fregata minor	Great frigatebird	N/A	Migratory	Marine	Migratory	
Sula leucogaster	Brown booby	N/A	Migratory	Marine	Migratory	
Sula sula	Red-footed booby	N/A	Migratory	Marine	Migratory	

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Species Name	**Common Name**	***Environment Protection and Biodiversity Conservation Act 1999***			**WA *Biodiversity Conservation Act 2016***	**EPBC Act Part 13 Statutory Instrument**
		Threatened Status	**Migratory Status**	**Listed**	**Conservation Status**	
Onychiprion anaethetus (listed as *Sterna anaethetus)*	Bridled tern	N/A	Migratory	Marine	Migratory	
Thalasseus bergii	Greater crested tern	N/A	Migratory	Marine	Migratory	
Sternula albifrons	Little tern	N/A	Migratory	Marine	Migratory	
Sterna dougallii	Roseate tern	N/A	Migratory	Marine	Migratory	
Onychoprion fuscata	Sooty tern	N/A	N/A	Marine	N/A	
Hydroprogne caspia	Caspian tern	N/A	Migratory	Marine	Migratory	
Ardenna pacifica	Wedge-tailed shearwater	N/A	Migratory	Marine	Migratory	
Puffinus assimillis	Little shearwater	N/A	N/A	Marine	N/A	
Ardenna carneipes	Flesh-footed shearwater	N/A	Migratory	Marine	Vulnerable	
Calonectris leucomelas	Streaked shearwater	N/A	Migratory	Marine	Migratory	
Phaethon lepturus	White-tailed tropicbird	N/A	Migratory	Marine	Migratory	
Chroicocephalus novaehollandiase	Silver gull	N/A	N/A	Marine	N/A	
Migratory shorebirds						
Numenius madagascariensis	Eastern curlew, Far Eastern curlew	Critically endangered	Migratory	Marine	Critically endangered	Conservation Advice *Numenius madagascariensis* eastern curlew (DOE, 2015a)
Calidris ferruginea	Curlew sandpiper	Critically endangered	Migratory	Marine	Critically endangered	Conservation Advice *Calidris ferruginea* curlew sandpiper (DOE, 2015b)
Calidris tenuirostris	Great knot	Critically endangered	Migratory	Marine	Critically endangered	Conservation Advice *Calidris tenuirostris* Great knot (Threatened Species Scientific Committee, 2016a)
Limosa lapponica menzbieri	Bar-tailed godwit (*menzbieri*)	Critically endangered	Migratory	Marine	Critically endangered	Conservation Advice *Limosa lapponica menzbieri* Bar-tailed godwit (northern Siberia). (Threatened Species Scientific Committee, 2016c)

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Species Name	**Common Name**	***Environment Protection and Biodiversity Conservation Act 1999***			**WA *Biodiversity Conservation Act 2016***	**EPBC Act Part 13 Statutory Instrument**
		Threatened Status	**Migratory Status**	**Listed**	**Conservation Status**	
Calidris canutus	Red knot	Endangered	Migratory	Marine	Endangered	Conservation Advice *Calidris canutus* Red knot (Threatened Species Scientific Committee, 2016b)
Charadrius mongolus	Lesser sand plover	Endangered	Migratory	Marine	Endangered	Conservation Advice *Charadrius mongolus* Lesser sand plover (Threatened Species Scientific Committee, 2016e)
Charadrius leschenaultii	Greater sand plover	Vulnerable	Migratory	Marine	Vulnerable	Conservation Advice *Charadrius leschenaultia* Greater sand plover (Threatened Species Scientific Committee, 2016d)
All migratory shorebird species	Wildlife Conservation Plan for Migratory Shorebirds (Commonwealth of Australia, 2015c).					

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8.2 Seabirds in the NWMR

Seabirds are birds that are adapted to life within the marine environment (oceanic and coastal) and are generally long-lived, have delayed breeding and have fewer young than other bird species (Commonwealth of Australia, 2019). At least 34 seabird species listed as threatened, migratory and/or marine under the EPBC Act are known to occur regularly in the NWMR and include a variety of species of terns, noddies, petrels, shearwaters, frigatebirds, and boobies. Many of these species spend most of their lives at sea (predominately pelagic species), ranging over large distances to forage. These pelagic species only come onshore to breed and raise chicks at natal or high-fidelity breeding colonies on remote, offshore island locations in and adjacent to the NWMR. Many species are ecologically significant to the NWMR, as they are endemic to the region, can be present in large numbers in breeding seasons and non-breeding seasons, and many exhibit extensive annual migrations that include marine areas outside the Australian EEZ (DSEWPAC, 2012e).

The presence of seabirds within the NWMR is influenced by seabird species that migrate and forage in the area during the non-breeding season and this includes many seabird species that breed on the Houtman Abrolhos in the SWMR. Pelagic seabirds have been documented foraging at current boundaries and seasonal upwellings within the NWMR (refer to Sutton *et al*., 2019). The Houtman Abrolhos Islands National Park located in the SWMR, is one of the most significant seabird breeding locations in the eastern Indian Ocean. Sixteen (16) species of seabirds breed there. Eighty percent of common (brown) noddies, 40% of sooty terns and all the lesser noddies found in Australia nest at the Houtman Abrolhos (Surman, 2019). Important seabird areas in the NWMR are as identified by the KBAs (refer to **Section 8.1**) and the information on a select number of seabird species documented for the NWMR (based on the screening criteria presented in **Section 3**), as presented in **Table 8-2**.

Table 8-2 Information on threatened/migratory seabird species of the NWMR

Species	Key Information
Seabirds	
Southern giant petrel	This species is included in the National recovery plan for threatened albatrosses and giant petrels. Habitat critical to survival is defined for breeding and foraging. There are six known breeding localities under Australian jurisdiction (for all species giant petrels) and all are located in the Southern Ocean including islands off Tasmania and within the Australian Antarctic Territory (DSEWPAC, 2011c). Habitat critical to survival identified for foraging is defined as waters south of 25 degrees latitude. The giant petrel species distribution is mainly within the Southern Ocean but this species does migrate into subtropical waters during the winter and its distribution includes the southern extent of the NWMR. No BIAs for this species are located in the NWMR.
Abbott's booby	The Abbott's booby is a large, long-lived seabird known to nest only at Christmas Island. The recovery of this species is strongly dependent on the protection of breeding habitat defined habitat critical to the survival of this species on Christmas Island (Threatened Species Scientific Committee, 2020b). This species spends much of its time at sea and known to forage over large distances offshore when nesting and its range includes off the coast of Java, near the Chagos and in the Banda Sea, and may possibly extend into the north-western extent of the NWMR. No BIAs for this species are located in the NWMR.
Soft-plumaged petrel	This petrel species breeds only at two locations in Australian waters within the Southern Ocean (one off Tasmania and Macquarie Island) (Threatened Species Scientific Committee, 2015f). As a mainly sub-Antarctic species they are usually distributed in cooler seas but distribution extents into subtropical waters and its known distribution includes the southern extent of the NWMR. No BIAs for this species are located in the NWMR.
Australian fairy tern	The Australian fairy tern is listed as Vulnerable for the sub-species only recorded for WA. It has a coastal distribution from Sydney, south to Tasmania and around southern WA up to the Dampier Archipelago and out on the offshore island groups of Barrow, Montebello and the Lowendals (DSEWPAC, 2011d). The Australian fairy tern feeds on small baitfish and roosts and nests on sandy beaches below vegetation. These behaviours, generally, occur in inshore waters of island archipelagos and on the Australian mainland shores and adjacent wetlands. Fairy terns breed from August to February. The Australian fairy tern is unlikely to be present

Species	Key Information
	within the offshore environment of the NWMR. The largest breeding colony in Western Australia for this species is in the Houtman Abrolhos Islands, SWMR (Surman, 2019). For the description and location of BIAs in the NWMR, refer to **Table 8-3** and **Figure 8-2.**
Australian lesser noddy	The Houtman Abrolhos, WA is an important breeding habitat for the Australian lesser noddy in the eastern Indian Ocean. This species exhibits nesting habitat specialisation (white mangrove stands) and has a limited foraging range during the breeding season. Furthermore, the lesser noddy forages over shelf waters and appears not to disperse over their non-breeding period as they remain largely in the general vicinity or slightly to the south of the colony in the non-breeding season (February to September; Surman *et al*., 2018). No BIAs for this species are located in the NWMR.
Indian yellow-nosed albatross	This species is included in the National recovery plan for threatened albatrosses and giant petrels. Habitat critical to survival is defined for breeding and foraging. There are six known breeding localities under Australian jurisdiction (for all species of albatrosses) and all are located in the Southern Ocean including islands off Tasmania and within the Australian Antarctic Territory (DSEWPAC, 2011c). Habitat critical to survival identified for foraging is defined as waters south of 25 degrees latitude. All albatross species distribution (including the Indian yellow-nose albatross) is mainly within the Southern Ocean but this species does migrate into subtropical waters during the winter and its distribution includes the southern extent of the NWMR. No BIAs for this species are located in the NWMR.
Common noddy	This species is listed as migratory and marine. The common (or brown) noddy is the largest species of noddy found in Australian waters. The species is widespread in tropical and subtropical areas beyond Australia. This seabird species is gregarious and normally occurs in flocks, up to hundreds of individuals, when feeding or roosting. The Houtman Abrolhos, WA is the primary breeding habitat for the common noddy in the Eastern Indian Ocean. This species spends their non-breeding season (March to August) in the NWS area, around 950 km north from the breeding colony (Surman *et al*. 2018). The species occurs within NWMR waters, particularly around offshore islands such as the Montebello Island group. This species is recorded on unmanned oil and gas platforms within the NWS. No BIAs for this species are located in the NWMR.
Lesser frigatebird **Great frigatebird**	Both species of frigatebird are listed as migratory and marine. Within the NWMR, the lesser frigatebird is known to breed on Adele, Bedout and West Lacepede islands, Ashmore Reef and Cartier Island (Commonwealth of Australia, 2019). The lesser frigatebird feeds mostly on fish and sometimes cephalopods, and all food is taken while the bird is in flight. Lesser frigatebirds generally forage close to breeding colonies. Breeding/foraging BIAs for the lesser frigatebird are located in the NWMR; refer to **Table 8-3**.
Brown booby	The brown booby is the most common booby, occurring throughout all tropical oceans bounded by latitudes 30º N and 30º S. There are large colonies on offshore islands within the NWMR such as the Lacepede Islands (one of the largest colonies in the world), Ashmore Reef, and other offshore Kimberley islands. This seabird species is a specialised plunge diver, mostly eating fish and some cephalopods (Commonwealth of Australia, 2019). Breeding/foraging BIAs for the brown booby are located in the NWMR; refer to **Table 8-3** and **Figure 8-3**.
Red-footed booby	Within the NWMR, its known breeding sites for this species include Ashmore Reef and Cartier Island. It is a pelagic species and generally occurs away from land. It mainly eats flying fish and squid. Prey abundance is reliant on the high productivity in slope areas off remote islands where the birds breed (Commonwealth of Australia, 2019). Breeding/foraging BIAs for the red-footed booby are located in the NWMR; refer to **Table 8-3** and **Figure 8-3**.
Greater crested tern	The greater crested tern has a widespread distribution recorded on islands and coastlines of tropical and subtropical areas, ranging from the Atlantic coast of South Africa, Indian Ocean and through south-east Asia and Australia. Outside the breeding season it can be found at sea throughout its range, with the exception of the central Indian Ocean (Commonwealth of Australia, 2019). The largest breeding colony in WA for this species is the Houtman Abrolhos Islands, SWMR (Surman, 2019). No BIAs for this species are located in the NWMR.
Little tern	There are three sub-populations of this species in Australia and two of these occur in the NWMR: northern Australian breeding sub-population occurring around Broome and extending across in to the NMR, and an east Asian breeding sub-population, with the terns present from Shark Bay to south-eastern Queensland during the austral summer. Little terns

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Species	Key Information
	usually forage close to breeding colonies in the shallow water of estuaries (Commonwealth of Australia, 2019). For the description and location of BIAs in the NWMR, refer to **Table 8-3** and **Figure 8-2**.
Roseate tern	This species is generally tropical in distribution and there are many breeding populations in the NWMR, including Ashmore Reef, Napier Broome Bay, Bonaparte Archipelago, Lacepede Islands, Dampier Archipelago and the Lowendal Islands. A large number of non-breeding roseate terns have been observed at several remote locations in the Kimberley and there are high numbers also recorded for Eighty Mile Beach Ramsar site. The Kimberley colonies are likely to be another sub-species that breeds in east Asia. Roseate terns predominately eat small pelagic fish (Commonwealth of Australia, 2019). The largest breeding colony in Western Australia for this species is in the Houtman Abrolhos Islands, SWMR (Surman, 2019). For the description and location of BIAs in the NWMR, refer to **Table 8-3** and **Figure 8-2**.
Wedge-tailed shearwater	The wedge-tailed shearwater is a pelagic, marine seabird known from tropical and subtropical waters. Its distribution is widespread across the Indian and Pacific oceans. It is known to breed on the east and west coasts (and offshore islands) of Australia. This species is known to consume fish, cephalopods, and other biota primarily via contact-dipping. Wedge-tailed shearwaters are now understood to undertake extensive foraging trips (over thousands of kilometres over periods of days when chicking and provisioning young) and much longer and extensive pelagic travels over the north-west Indian Ocean during the non-breeding season, targeting current boundaries and upwellings. The species breeds throughout its range, mainly on vegetated islands, atolls and cays and excavates burrows in the ground where chicks are raised (Commonwealth of Australia, 2019). Large breeding colonies of the wedge-tailed shearwater are located on the Houtman Abrolhos islands (SWMR) (Surman *et al*., 2018) and several locations in the NWMR including: Muiron Islands (North-west Cape), Varanus Island and the Dampier Archipelago in the Pilbara where burrow numbers were estimated to several hundred thousand to half a million such as on the Muiron Islands, though it is not known if all burrows are utilised on an annual basis (Birdlife Australia, 2018; Surman *et al.*, 2018). Cannell *et al* (2019) satellite tracked adult wedge-tailed shearwaters during egg incubation and chick rearing on the Muiron Islands in January 2018. For the incubation trips, there was a strong consistency for the birds to travel towards seamounts, typically located north-west of the Muiron Islands, between Australia and Indonesia. One bird however remained south-west of the islands, in the Cape Range Canyon. A similar pattern to utilise areas associated with sea mounts was also observed for the long foraging trips during chick rearing, though some of the foraging was concentrated in deeper waters. A bimodal foraging strategy during chick-rearing was observed, with adults undertaking long foraging trips after a series of shorter foraging trips within the NWMR. Surman *et al*. (2018) reported most wedge-tailed shearwaters from the breeding colonies on the Houtman Abrolhos undertook extensive non-breeding migrations. This seabird species occupied waters adjacent or to the north of their nesting sites or migrated 4200 km north-west into the equatorial central Indian Ocean near the Ninety East Ridge during the non-breeding season (later April to mid-November). For the description and location of BIAs in the NWMR, refer to **Table 8-3** and **Figure 8-1**.
Flesh-footed shearwater	The species mainly occurs in the subtropics, over continental shelves and slopes and occasionally inshore waters, with individual birds pass through the tropics and over deeper waters during migration to the North Pacific and Indian oceans (Commonwealth of Australia, 2019). They are a common visitor to the waters off southern Australia, from south-western WA to south-eastern Queensland. The fleshy-footed shearwater is a trans-equatorial migrant, breeding from late September to May off south-western Australia, and migrating north by early May, across the southern Indian and possibly Indonesia to the northern Pacific Ocean. No BIAs for the flesh-footed shearwater are located in the NWMR.
Streaked shearwater	The streaked shearwater has a broad distribution in the western Pacific Ocean, breeding on the coast and offshore islands of Japan, Russia, China and the Korean Peninsula. During winter months (non-breeding season), the species undertakes trans-equatorial migration to the coasts of Vietnam, New Guinea, the Philippines, Australia, southern India and Sri Lanka. The streaked shearwater feeds mainly on fish and squid that it catches by surface-seizing and shallow plunges (Commonwealth of Australia, 2019). No BIAs for the streaked shearwater are located in the NWMR.
White-tailed tropicbird	Tropicbirds are predominately pelagic species and the white-tailed tropicbird forages in warm waters and over long distances (pan-tropical). The species is most common off north-west Australia. In the NWMR, this species is considered a sub-species and are limited in number and distribution. Nesting sites are known for Clerke Reef (Rowley Shoals) and Ashmore

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Species	Key Information
	Reef. Christmas Island is also a known nesting site and the species can disperse several thousand kilometres during foraging trips. This species feeds mainly on fish and cephalopods, captured by deep plunge diving (Commonwealth of Australia, 2019). There are breeding BIAs at the Rowley Shoals and Ashmore Reef within the NWMR for the white-tailed tropicbird; refer to **Table 8-3**.
Silver gull	The silver gull is typically described as an inshore and coastal foraging seabird and has an Australian-wide distribution including locations within the NWMR. It is noted as it has been recorded on unmanned oil and gas platforms located within the NWS.

8.2.1 Biologically Important Areas in the NWMR

BIAs representing important life cycle stages and behaviours for eight species of seabird in the NWMR are presented in **Table 8-3**.

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Table 8-3 Seabird BIAs within the NWMR

Seabird Species	Woodside Activity Area			BIAs			
	Browse	NWS/S	NWC	Breeding/foraging	Foraging	Breeding	Resting
Australia fairy tern	-	✓	✓	-	No foraging BIAs in the NWMR Foraging in high numbers: the BIA is located in the SWMR including the Houtman Abrolhos Islands	Dampier Archipelago, Montebello, Lowendal and Barrow Island Groups, south Ningaloo and barrier island of Shark Bay	-
Wedge-tailed shearwater	✓	✓	✓	Widespread area of the NWMR offshore and inshore waters	Foraging in high numbers: the BIA is located in the SWMR including the Houtman Abrolhos Islands	-	-
Great frigatebird	✓	-	-	Ashmore Reef, Adele Island	-	-	-
Lesser frigatebird	✓	✓	-	Off Eighty Mile Beach, Lacepedes, Adele Island, North Kimberley and Ashmore Reef	-	-	-
Brown booby	✓	✓	-	Off Eighty Mile Beach, Lacepedes, Adele Island, North Kimberley and Ashmore Reef	-	-	-
Red-footed booby	✓	-	-	Adele Island, Ashmore Reef	-	-	-
Little tern	✓	✓	-	Rowley Shoals, Adele Island	-	-	-
Roseate tern	✓	✓	✓	-	No foraging BIAs in the NWMR Foraging (provisioning young) and foraging BIAs located in the SWMR – Houtman Abrolhos Islands the	Dampier Archipelago, Montebello, Lowendal and Barrow Island Groups, south Ningaloo and barrier island of Shark Bay	Eighty Mile Beach

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Seabird Species	Woodside Activity Area			BIAs			
	Browse	NWS/S	NWC	Breeding/foraging	Foraging	Breeding	Resting
					nearest BIA to the NWMR		
White-tailed tropicbird	✓	-	-			Rowley Shoals Ashmore Reef	

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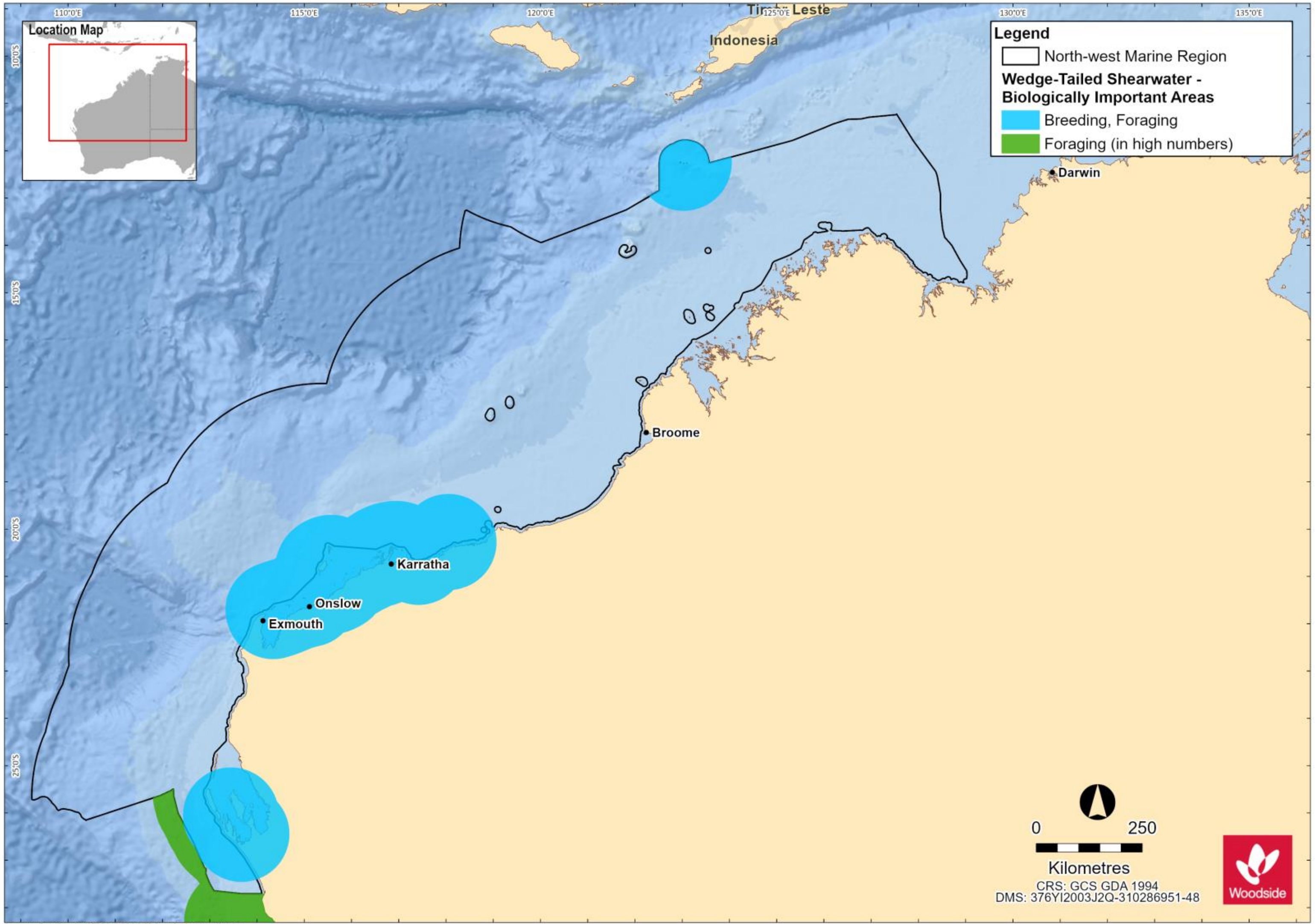

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Figure 8-1 Wedge-tailed shearwater BIAs for the NWMR

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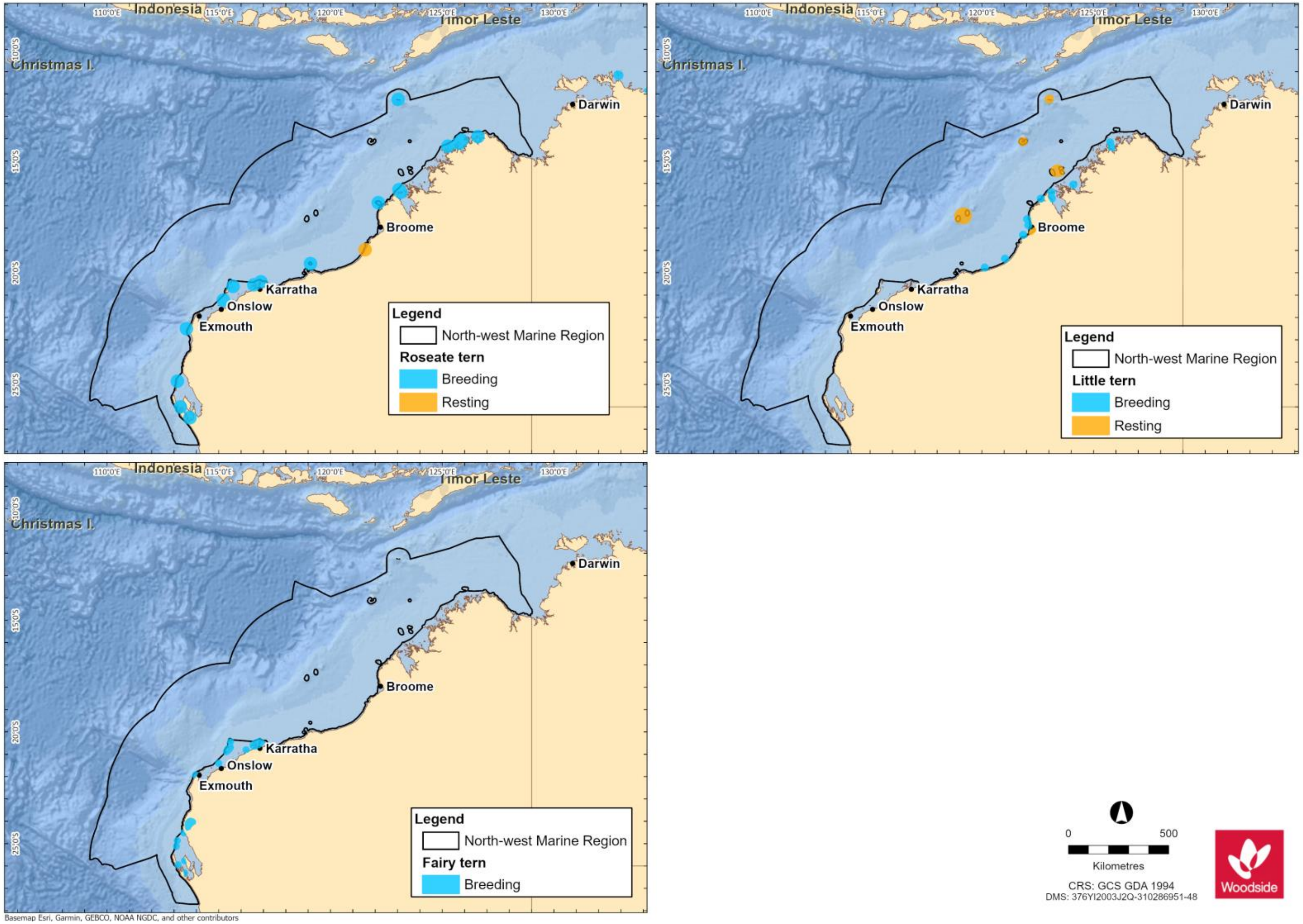

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Figure 8-2 Tern species BIAs for the NWMR

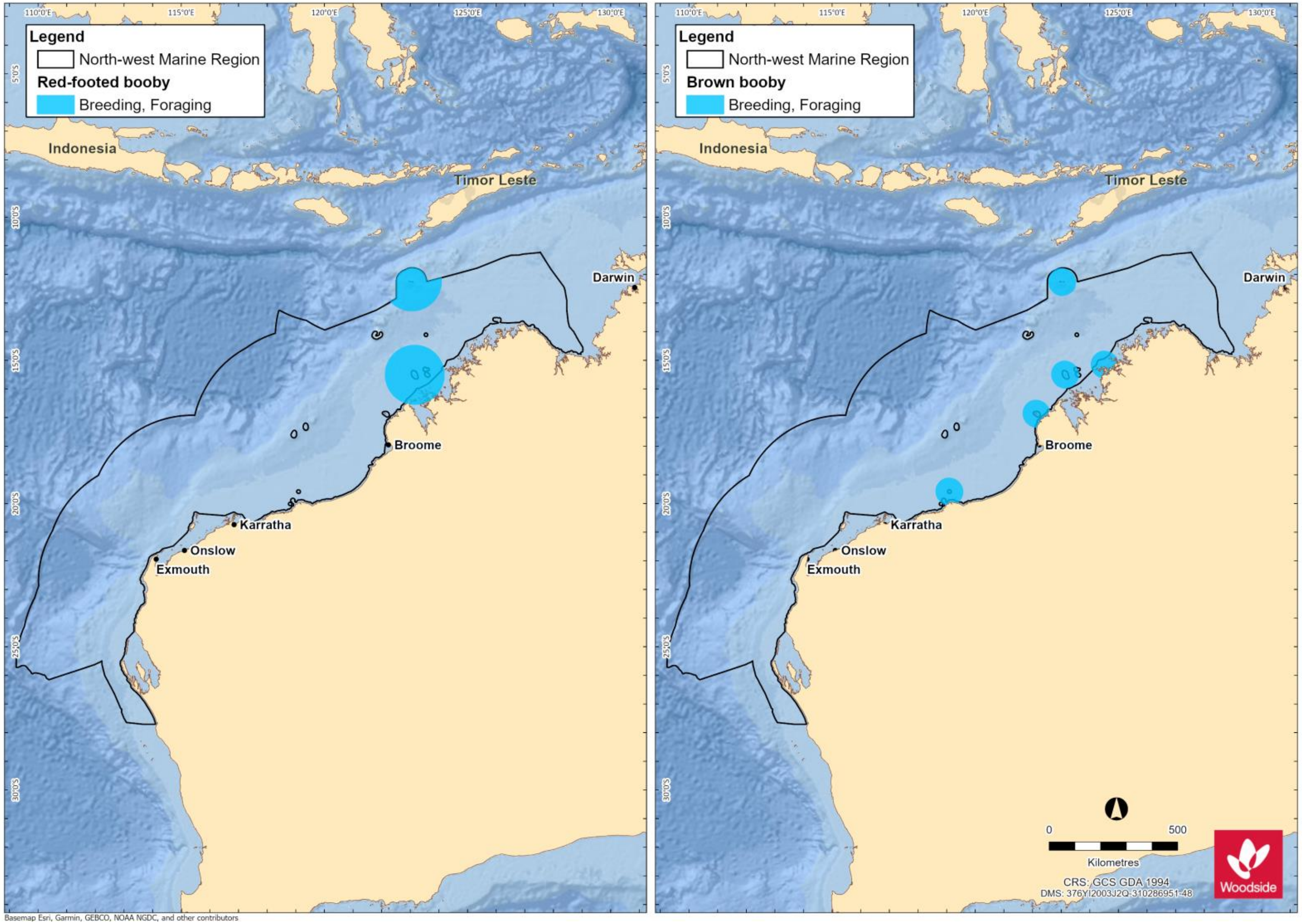

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Figure 8-3 Red-footed and brown booby BIAs for the NWMR

8.2.2 Seabird Summary for NWMR

8.2.2.1 Browse

The Browse activity area includes biologically important habitat for seven threatened and/or migratory seabird species:

- wedge-tailed shearwater (breeding/foraging);
- great and lesser frigatebirds (breeding/foraging);
- brown booby (breeding/foraging);
- red-footed booby (breeding/foraging);
- little tern (breeding/foraging);
- roseate tern (breeding and resting); and,
- white-tailed tropicbird (breeding).

BIAs for the seabird species are outlined in **Table 8-3**.

8.2.2.2 NWS / Scarborough

The NWS / Scarborough activity area includes biologically important habitat for five threatened and/or migratory seabird species:

- wedge-tailed shearwater (breeding/foraging);
- lesser frigatebird (breeding/foraging);
- brown booby (breeding/foraging);
- little tern (breeding/foraging); and
- roseate tern (breeding and resting).

BIAs for the seabird species are outlined in **Table 8-3**.

8.2.2.3 North-west Cape

The North-west Cape activity area includes biologically important habitat for five threatened and/or migratory seabird species:

- Australian fairy tern (breeding);
- wedge-tailed shearwater (breeding/foraging); and
- roseate tern (breeding and resting).

BIAs for the seabird species are outlined in **Table 8-3**.

8.3 Shorebirds

Shorebirds (migratory and resident species) are generally associated with wetland or coastal environments, and the NWMR hosts a large number of many shorebird species, particularly in the Austral summer (refer to **Appendix A** for the EPBC Act PMST reports on listed species of shorebirds). Shorebirds may use coastal environments for feeding, nesting or migratory stopovers. In coastal environments, shorebirds generally feed during low tide on exposed intertidal mud and sand flats, and roost in suitable habitat above the high water mark. Many shorebird species undergo annual migrations, typically breeding at high latitudes of the Northern Hemisphere and migrating south for the non-breeding season and Australia is part of the East Asian-Australasian Flyway (EAAF). The EAAF extends from breeding grounds in the Russian tundra, Mongolia and Alaska

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southwards through east and south-east Asia, to non-breeding areas of Indonesia, Papua New Guinea, Australia and New Zealand (Weller and Lee, 2017). The EAAF is of most relevance to the NWMR. There are 37 species of shorebird which annually migrate to Australia via the EAAF and 36 of these species spend the austral summer (non-breeding season) foraging and roosting in coastal and wetland habitats (Commonwealth of Australia, 2015c; Weller and Lee, 2017).

Ashmore Reef is documented as a BIA for migratory shorebirds in the NWMR (DSEWPAC, 2012a).

Table 8-4. Information on threatened/migratory shorebird species of the NWMR

Species	Key Information
Shorebirds	
Eastern curlew, Far eastern curlew	This species is the largest, migratory shorebird in the world, with a long neck, long legs and a very long downcurved bill and is a long-haul flyer. 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 EAAF and is a non-breeding visitor to Australia from August to March, primarily foraging on crabs and molluscs in intertidal mudflats. During the non-breeding season in Australia, this species is most associated with sheltered coasts, especially estuaries, bays, harbours, inlets and coastal lagoons, with large intertidal mudflats or sandflats, often with beds of seagrass (DOE, 2015a).
Curlew sandpiper	The curlew sandpiper breeds in northern Siberia but has a non-breeding range that extends from western Africa to Australia, with small numbers reaching New Zealand (Bamford *et al*., 2008). In Australia, curlew sandpipers occur around the coasts and are also quite widespread inland, though in smaller numbers. Records occur in all states and the NT during the non-breeding period, and also during the breeding season when many non-breeding one-year old birds remain in Australia rather than migrating north along the EAAF. The species preferred habitat for foraging is mudflats and nearby shallow waters in sheltered coastal areas such as estuaries, bay, inlets and lagoons (DOE, 2015b).
Great knot	The great knot breeds in the Northern Hemisphere and undertakes biannual migrations along the EAAF to non-breeding habitat in Australia. The great knot winters in Australia and has been recorded around the entirety of the Australian coast the greatest numbers are found in northern Western Australia (Pilbara (Dampier Archipelago) and Kimberley and the Northern Territory. In Australia, this species prefers sheltered, coastal habitat with large intertidal mudflats or sandflats (inkling inlets, bays, harbours, estuaries and lagoons). High numbers (exceeding several thousand birds are regularly recorded from Roebuck Bay. The great knot feeds on a variety of invertebrates by pecking at or just below the surface of moist mud or sand (Threatened Species Scientific Committee, 2016a).
Bar-tailed godwit (*menzbieri*)	The bar-tailed godwit is a large, migratory shorebird and there are two sub-species in the EAAF (*Limosa lapponica baueri* and *L. l. menzbieri*). The sub-species *L. l. menzbieri* breeds in northern Siberia and spends its non-breeding period mostly in the north of WA but also in South-east Asia. The bar-tailed godwit (*menzbieri*) usually forages near the water in shallow water, mainly in tidal estuaries and harbours with a preference for exposed sandy or soft mud substrates on intertidal flats, banks and beaches (Threatened Species Scientific Committee, 2016c).
Red knot (*piersmai*)	This species is a small to medium migratory shorebird. There are two sub-species that cannot be distinguished from each other in nonbreeding plumage, however, *Calidris canutus piersmai* tend to overwinter almost exclusively in north-west Australia. The red knot migrates long distances from breeding grounds in high northern latitudes, where it breeds during the boreal summer, to the Southern Hemisphere during the austral summer with migration along the EAAF. Very large numbers are recorded for the north-west Australia and is common in all suitable habitats around the coast, including inland clay pans near Roebuck Bay (where the species roosts). The red knot usually forages in soft substrate along the waters edge on intertidal mudflats, sandflats and sandy beaches of sheltered coasts (Threatened Species Scientific Committee, 2016b).
Lesser sand plover	The lesser sand plover is a small to medium shorebird and one of 36 migratory shorebirds that breed in the Northern Hemisphere during the boreal summer and are known to annually migrate to the non-breeding grounds of Australia along the EAAF for the austral summer. There are five different sub-species and it is most likely the non-breeding ranges of the sub-species *Charadrius m. mongolus* overlaps with the NWMR. This species is widespread in coastal regions, preferring sandy beaches, mudflats of coastal bays and estuaries (Threatened Species Scientific Committee, 2016e).
Greater sand plover	The greater sand plover is a small to medium shorebird and in its non-breeding plumage is difficult to distinguish from the lesser sand plover. This species breeds in the Northern

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Species	Key Information
	Hemisphere and undertakes annual migrations to and from Southern Hemisphere feeding grounds in the austral summer along the EAAF. The species distribution in Australia during the non-breeding season is widespread, in WA the greater sand plover is widespread between Northwest Cape and Roebuck Bay (Threatened Species Scientific Committee, 2016d).

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9. KEY ECOLOGICAL FEATURES

Key ecological features (KEFs) are elements of the Commonwealth marine environment that are considered to be important for a marine region's biodiversity or ecosystem function and integrity. KEFs have been identified by the Australian Government based on advice from scientists about the ecological processes and characteristics of the area.

KEFs meet one or more of the following criteria:

- a species, group of species, or a community with a regionally important ecological role (e.g. a predator, prey that affects a large biomass or number of other marine species),
- a species, group of species or a community that is nationally or regionally important for biodiversity,
- an area or habitat that is nationally or regionally important for:
  - enhanced or high productivity (such as predictable upwellings – an upwelling occurs when cold nutrient-rich waters from the bottom of the ocean rise to the surface),
  - aggregations of marine life (such as feeding, resting, breeding or nursery areas), or
  - biodiversity and endemism (species which only occur in a specific area),
- a unique seafloor feature, with known or presumed ecological properties of regional significance.

Thirteen KEFs are designated within the NWMR, twelve KEFs within the SWMR and eight KEFs within the NMR. These KEFs have been identified in the Protected Matters search (**Appendix A**) and outlined in **Table 9-1, Table 9-2** and **Table 9-3,** and **Figure 9-1, Figure 9-2** and **Figure 9-3**.

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Table 9-1 Key Ecological Features (KEF) within the NWMR

KEF Name	Woodside Activity Area			Values[1]	Description
	Browse	NWS/S	NW Cape		
Carbonate bank and terrace system of the Sahul Shelf	✓	-	-	Unique seafloor feature with ecological properties of regional significance Regionally important because of their role in enhancing biodiversity and local productivity relative to their surrounds. The carbonate banks and terraces provide areas of hard substrate in an otherwise soft sediment environment which are important for sessile species	The Carbonate banks and terrace system of the Sahul Shelf are located in the western Joseph Bonaparte Gulf and to the north of Cape Bougainville and Cape Londonderry. The carbonate banks and terraces are part of a larger complex of banks and terraces that occurs on the Van Diemen Rise in the adjacent NMR. The bank and terrace system of the Van Diemen Rise covers approximately 31,278 km^2 and forms part of the larger system associated with the Sahul Banks to the north and Londonderry Rise to the east. The feature is characterised by terrace, banks, channels and valleys (DSEWPAC, 2012c). The banks, ridges and terraces of the Van Diemen Rise are raised geomorphic features with relatively high proportions of hard substrate that support sponge and octocoral gardens. These, in turn, provide habitat to other epifauna, by providing structure in an otherwise flat environment (Przeslawski *et al.*, 2011). Plains and valleys are characterised by scattered epifauna and infauna that include polychaetes and ascidians. These epibenthic communities support higher order species such as olive ridley turtles, sea snakes and sharks (DSEWPAC, 2012c)
Pinnacles of the Bonaparte Basin	✓	-	-	Unique seafloor feature with ecological properties of regional significance Provide areas of hard substrate in an otherwise soft sediment environment and so are important for sessile species Recognised as a biodiversity hotspot for sponges The Pinnacles of the Bonaparte Basin KEF is located within both the NWMR and NMR (refer **Table 9-3**)	The Pinnacles of the Bonaparte Basin provide areas of hard substrate in an otherwise relatively featureless environment, the pinnacles are likely to support a high number of species, although a better understanding of the species richness and diversity associated with these structures is required (DSEWPAC, 2012a, 2012c). Covering >520 km^2 within the Bonaparte Basin, this feature contains the largest concentration of pinnacles along the Australian margin. The Pinnacles of the Bonaparte Basin are thought to be the eroded remnants of underlying strata; it is likely that the vertical walls generate local upwelling of nutrient-rich water, leading to phytoplankton productivity that attracts aggregations of planktivorous and predatory fish, seabirds, and foraging turtles (DSEWPAC, 2012a, 2012c).
Ashmore Reef and Cartier Island and surrounding Commonwealth waters	✓	-	-	High productivity, biodiversity and aggregation of marine life that apply to both the benthic and pelagic habitats within the feature	Ashmore Reef is the largest of only three emergent oceanic reefs present in the north-eastern Indian Ocean and is the only oceanic reef in the region with vegetated islands. Ashmore contains a large reef shelf, two large lagoons, several channelled carbonate sand flats, shifting sand cays, an extensive reef flat, three vegetated islands—East, Middle and West islands—and

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KEF Name	Woodside Activity Area			Values[1]	Description
	Browse	NWS/S	NW Cape		
					surrounding waters. Rising from a depth of more than 100 m, the reef platform is at the edge of the NWS and covers an area of 239 km². Ashmore Reef and Cartier Island and the surrounding Commonwealth waters are regionally important for feeding and breeding aggregations of birds and other marine life; they are areas of enhanced primary productivity in an otherwise low-nutrient environment (DSEWPAC, 2012a). Ashmore Reef supports the highest number of coral species of any reef off the WA coast.
Seringapatam Reef and the Commonwealth waters in the Scott Reef complex	✓	-	-	Support diverse aggregations of marine life, have high primary productivity relative to other parts of the region, are relatively pristine and have high species richness, which apply to both the benthic and pelagic habitats within the feature	Seringapatam Reef and the Commonwealth waters in the Scott Reef complex are regionally important in supporting the diverse aggregations of marine life, high primary productivity, and high species richness associated with the reefs themselves. As two of the few offshore reefs in the north-west, they provide an important biophysical environment in the region (DSEWPAC, 2012a).
Continental slope demersal fish communities	✓	✓	✓	High biodiversity of demersal fish assemblages, including high levels of endemism	The diversity of demersal fish assemblages on the continental slope in the Timor Province, the Northwest Transition and the North-west Province is high compared to elsewhere along the Australian continental slope (DSEWPAC, 2012a). The continental slope between North-west Cape and the Montebello Trough has more than 500 fish species, 76 of which are endemic, which makes it the most diverse slope bioregion in Australia (Last *et al.*, 2005). The slope of the Timor Province and the Northwest Transition also contains more than 500 species of demersal fishes of which 64 are considered endemic (Last *et al.*, 2005), making it the second richest area for demersal fishes throughout the whole continental slope. Demersal fish species occupy two distinct demersal biomes associated with the upper slope (225–500 m water depths) and the mid-slope (750–1000 m). Although poorly known, it is suggested that the demersal slope communities rely on bacteria and detritus-based systems comprised of infauna and epifauna, which in turn become prey for a range of teleost fishes, molluscs and crustaceans (Brewer *et al.*, 2007). Higher-order consumers may include carnivorous fishes, deepwater sharks, large squid, and toothed whales (Brewer *et al.*, 2007). Pelagic production is phytoplankton-based, with hot spots around oceanic reefs and islands (Brewer *et al.*, 2007).

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KEF Name	Woodside Activity Area			Values[1]	Description
	Browse	NWS/S	NW Cape		
Ancient coastline at 125 m depth contour	✓	✓	✓	Unique seafloor feature with ecological properties of regional significance Provides areas of hard substrate and therefore may provide sites for higher diversity and enhanced species richness relative to surrounding areas of predominantly soft sediment	Several steps and terraces as a result of Holocene sea level changes occur in the region, with the most prominent of these features occurring as an escarpment along the NWMR and Sahul Shelf at a water depth of 125 m. The Ancient Coastline is not continuous throughout the NWMR and coincides with a well-documented eustatic stillstand at about 130 m worldwide (Falkner *et al.*, 2009). Where the Ancient Coastline provides areas of hard substrate, it may contribute to higher diversity and enhanced species richness relative to soft sediment habitat (Falkner *et al.*, 2009). 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. Although the Ancient Coastline adds additional habitat types to a representative system, the habitat types are not unique to the coastline as they are widespread on the upper shelf (Falkner *et al.*, 2009)
Canyons linking the Argo Abyssal Plain and Scott Plateau	-	✓	-	Facilitates nutrient upwelling, creating enhanced productivity and encouraging diverse aggregations of marine life	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, sea snakes, sharks, predatory fishes and seabirds are known to occur in the area due to its enhanced productivity (Sleeman *et al.*, 2007).
Glomar Shoal	-	✓	-	An area of high productivity and aggregations of marine life including commercial and recreational fish species	Glomar Shoal is a submerged littoral feature located about 150 km north of Dampier on the Rowley shelf at depths of 33–77 m (Falkner *et al.*, 2009). Studies by Abdul Wahab *et al.* (2018) found a number of hard coral and sponge species in water depths less than 40 m. One hundred and seventy (170) different species of fishes were detected with greatest species richness and abundance in shallow habitats (Abdul Wahab *et al.*, 2018). Fish species present include a number of commercial and recreational species such as Rankin cod, brown striped snapper, red emperor, crimson snapper, bream and yellow-spotted triggerfish (Falkner *et al.*, 2009; Fletcher and Santoro, 2009). These species have recorded high catch rates associated with Glomar Shoal, indicating that the shoal is likely to be an area of high productivity.

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KEF Name	Woodside Activity Area			Values[1]	Description
	Browse	NWS/S	NW Cape		
Mermaid Reef and Commonwealth waters surrounding Rowley Shoals	-	✓	-	Regionally important in supporting high species richness, higher productivity and aggregations of marine life	The Mermaid Reef and Commonwealth waters surrounding the Rowley Shoals KEF and is adjacent to the three nautical mile State waters limit surrounding Clerke and Imperieuse reefs, and include the Mermaid Reef Marine Park as described in **Section 10**. The reefs provide a distinctive biophysical environment in the region. They have steep and distinct reef slopes and associated fish communities. In evolutionary terms, the reefs may play a role in supplying coral and fish larvae to reefs further south via the southward flowing Indonesian Throughflow. Both coral communities and fish assemblages differ from similar habitats in eastern Australia (Done *et al.*, 1994).
Exmouth Plateau	-	✓	✓	Unique seafloor feature with ecological properties of regional significance, which apply to both benthic and pelagic habitats Likely to be an important area of biodiversity as it provides an extended area offshore for communities adapted to depths of approximately 1000 m	The Exmouth Plateau is a large, mid-slope, continental margin plateau that lies off the northwest coast of Australia. It ranges in depth from about 500 to more than 5000 m and is a major structural element of the Carnarvon Basin (Miyazaki and Stagg, 2013). The large size of the Exmouth Plateau and its expansive surface may modify deep water flow and be associated with the generation of internal tides; both of which may subsequently contribute to the upwelling of deeper, nutrient-rich waters closer to the surface (Brewer *et al.*, 2007). Satellite observations suggest that productivity is enhanced along the northern and southern boundaries of the plateau (Brewer *et al.*, 2007). Sediments on the plateau suggest that biological communities include scavengers, benthic filter feeders and epifauna (DSEWPAC, 2012a). Fauna in the pelagic waters above the plateau are likely to include small pelagic species and nekton attracted to seasonal upwellings, as well as larger predators such as billfishes, sharks and dolphins (Brewer *et al.*, 2007). Protected and migratory species are also known to pass through the region, including whale sharks and cetaceans.
Canyons linking the Cuvier Abyssal Plain and the Cape Range Peninsula	-	-	✓	Unique seafloor feature with ecological properties of regional significance The feature is an area of moderately enhanced productivity, attracting aggregations of fish and higher-order consumers such as large predatory	The canyons are associated with upwelling as they channel deep water from the Cuvier Abyssal Plain up onto the slope. This nutrient-rich water interacts with the Leeuwin Current at the canyon heads (DSEWPAC, 2012a). Aggregations of whale sharks, manta rays, sea snakes, sharks, large predatory fish, and seabirds are known to occur in this area.

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KEF Name	Woodside Activity Area			Values[1]	Description
	Browse	NWS/S	NW Cape		
				fish, sharks, toothed whales and dolphins Likely to be important due to their historical association with sperm whale aggregations	
Commonwealth waters adjacent to Ningaloo Reef	-	-	✓	High productivity and diverse aggregations of marine life The Commonwealth waters adjacent to Ningaloo Reef and associated canyons and plateau are interconnected and support the high productivity and species richness of Ningaloo Reef, globally significant as the only extensive coral reef in the world that fringes the west coast of a continent	The Leeuwin and Ningaloo currents interact, leading to areas of enhanced productivity in the Commonwealth waters adjacent to Ningaloo Reef. Aggregations of whale sharks, manta rays, humpback whales, sea snakes, sharks, large predatory fish, and seabirds are known to occur in this area (DSEWPAC, 2012a). The spatial boundary of this KEF, as defined in the NCVA, is defined as the waters contained in the existing Ningaloo AMP provided in **Section 10**.
Wallaby Saddle	-	-	✓	High productivity and aggregations of marine life: Representing almost the entire area of this type of geomorphic feature in the NWMR. It is a unique habitat that neither occurs anywhere else nearby (within hundreds of kilometres) nor with as large an area (Falkner *et al.* 2009)	The Wallaby Saddle may be an area of enhanced productivity. Historical whaling records provide evidence of sperm whale aggregations in the area of the Wallaby Saddle, possibly due to the enhanced productivity of the area and aggregations of baitfish (DSEWPAC, 2012a).

[1] Values description sourced from Marine bioregional plan for the North-west Marine Region (DSEWPAC, 2012a) and the Department of Agriculture, Water and the Environment (DAWE) SPRAT database.

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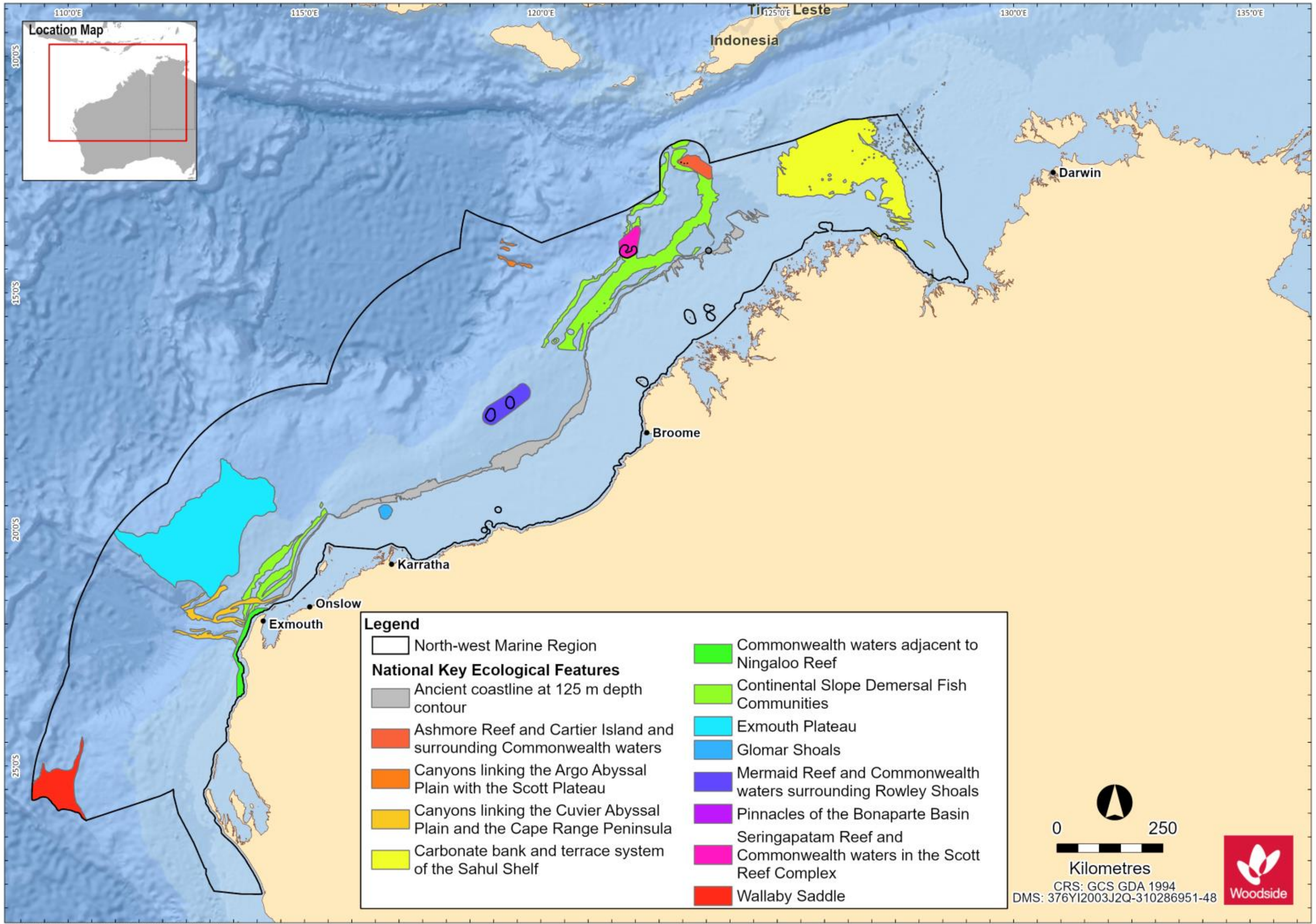

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Figure 9-1 Key Ecological Features (KEFs) within the NWMR.

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Table 9-2 Key Ecological Features (KEF) within the SWMR

KEF Name	Values[1]	Description
Albany Canyons group and adjacent shelf break	High productivity and aggregations of marine life, and unique seafloor feature with ecological properties of regional significance Both benthic and demersal habitats within the feature are of conservation value	The Albany Canyons group is thought to be associated with small, periodic subsurface upwelling events, which may drive localised regions of high productivity. The canyons are known to be a feeding area for sperm whale and sites of orange roughy aggregations. Anecdotal evidence also indicates that this area supports fish aggregations that attract large predatory fish and sharks.
Ancient coastline at 90-120 m depth	Relatively high productivity and aggregations of marine life, and high levels of biodiversity and endemism The feature creates topographic complexity, that may facilitate benthic biodiversity and enhanced biological productivity	Benthic biodiversity and productivity occur where the ancient coastline forms a prominent escarpment, such as in the western Great Australian Bight, where the sea floor is dominated by sponge communities of significant biodiversity and structural complexity.
Cape Mentelle upwelling	Facilitates nutrient upwelling, supporting high productivity and diverse aggregations of marine life	The Cape Mentelle upwelling draws relatively nutrient-rich water from the base of the Leeuwin Current, up the continental slope and onto the inner continental shelf, where it results in phytoplankton blooms at the surface. The phytoplankton blooms provide the basis for an extended food chain characterised by feeding aggregations of small pelagic fish, larger predatory fish, seabirds, dolphins and sharks.
Commonwealth marine environment surrounding the Houtman Abrolhos Islands (and adjacent shelf break)	High levels of biodiversity and endemism within benthic and pelagic habitats	The Houtman Abrolhos Islands and surrounding reefs support a unique mix of temperate and tropical species, resulting from the southward transport of species by the Leeuwin Current over thousands of years. The Houtman Abrolhos Islands are the largest seabird breeding station in the eastern Indian Ocean. They support more than one million pairs of breeding seabirds.

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KEF Name	Values[1]	Description
Commonwealth marine environment surrounding the Recherche Archipelago	Aggregations of marine life and high levels of biodiversity and endemism within benthic and demersal communities	The Recherche Archipelago is the most extensive area of reef in the SWMR. Its reef and seagrass habitat supports a high species diversity of warm temperate species, including 263 known species of fish, 347 known species of molluscs, 300 known species of sponges, and 242 known species of macroalgae. The islands also provide haul-out (resting areas) and breeding sites for Australian sea lions and New Zealand fur seals.
Commonwealth marine environment within and adjacent to the west-coast inshore lagoons	High productivity and aggregations of marine life within benthic and pelagic habitats Important for benthic productivity and recruitment for a range of marine species	These lagoons are important for benthic productivity, including macroalgae and seagrass communities, and breeding and nursery aggregations for many temperate and tropical marine species. They are important areas for the recruitment of commercially and recreationally important fish species. Extensive schools of migratory fish visit the area annually, including herring, garfish, tailor and Australian salmon.
Commonwealth marine environment within and adjacent to Geographe Bay	High productivity and aggregations of marine life, and high levels of biodiversity, recruitment within benthic and pelagic communities	Geographe Bay is known for its extensive beds of tropical and temperate seagrass that support a diversity of species, many of them not found anywhere else. The bay provides important nursery habitat for many species. Juvenile dusky whaler sharks use the shallow seagrass habitat as nursery grounds for several years, before ranging out to adult feeding grounds along the shelf break. The seagrass also provides valuable habitat for fish and invertebrates (Carruthers *et al.*, 2007). It is also an important resting area for migratory humpback whales.
Diamantina Fracture Zone	Unique seafloor feature with ecological properties of regional significance which apply to its benthic and demersal habitats	The Diamantina Fracture Zone is a rugged, deep- water environment of seamounts and numerous closely spaced troughs and ridges. Very little is known about the ecology of this remote, deep- water feature, but marine experts suggest that its size and physical complexity mean that it is likely to support deep-water communities characterised by high species diversity, with many species found nowhere else.
Naturaliste Plateau	Unique seafloor feature with ecological properties of regional significance including high species diversity and endemism which apply to its benthic and demersal habitats	The Naturaliste Plateau is Australia’s deepest temperate marginal plateau. The combination of its structural complexity, mixed water dynamics and relative isolation indicate that it supports deep- water communities with high species diversity and endemism.
Perth Canyon and adjacent shelf break, and other west-coast canyons	An area of higher productivity that attracts feeding aggregations of deep-diving mammals and large predatory fish. It is also recognised as a unique seafloor feature with ecological properties of regional significance	The Perth Canyon is the largest known undersea canyon in Australian waters. Deep ocean currents rise to the surface, creating a nutrient-rich cold- water habitat attracting feeding aggregations of deep-diving mammals, such as pygmy blue whales and large predatory fish that feed on aggregations of small fish, krill and squid.

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KEF Name	Values[1]	Description
Western demersal slope and associated fish communities of the Central Western Province	Provides important habitat for demersal fish communities and supports species groups that are nationally or regionally important to biodiversity	The western demersal slope provides important habitat for demersal fish communities, with a high level of diversity and endemism. A diverse assemblage of demersal fish species below a depth of 400 m is dominated by relatively small benthic species such as grenadiers, dogfish and cucumber fish. Unlike other slope fish communities in Australia, many of these species display unique physical adaptations to feed on the sea floor (such as a mouth position adapted to bottom feeding), and many do not appear to migrate vertically in their daily feeding habits.
Western rock lobster	A species that plays a regionally important ecological role	This species is the dominant large benthic invertebrate in the region. The lobster plays an important trophic role in many of the inshore ecosystems of the SWMR. Western rock lobsters are an important part of the food web on the inner shelf, particularly as juveniles.

[1] *Values description sourced from Marine bioregional plan for the South-west Marine Region (DSEWPAC, 2012b) and the Department of Agriculture, Water and the Environment (DAWE) SPRAT database*

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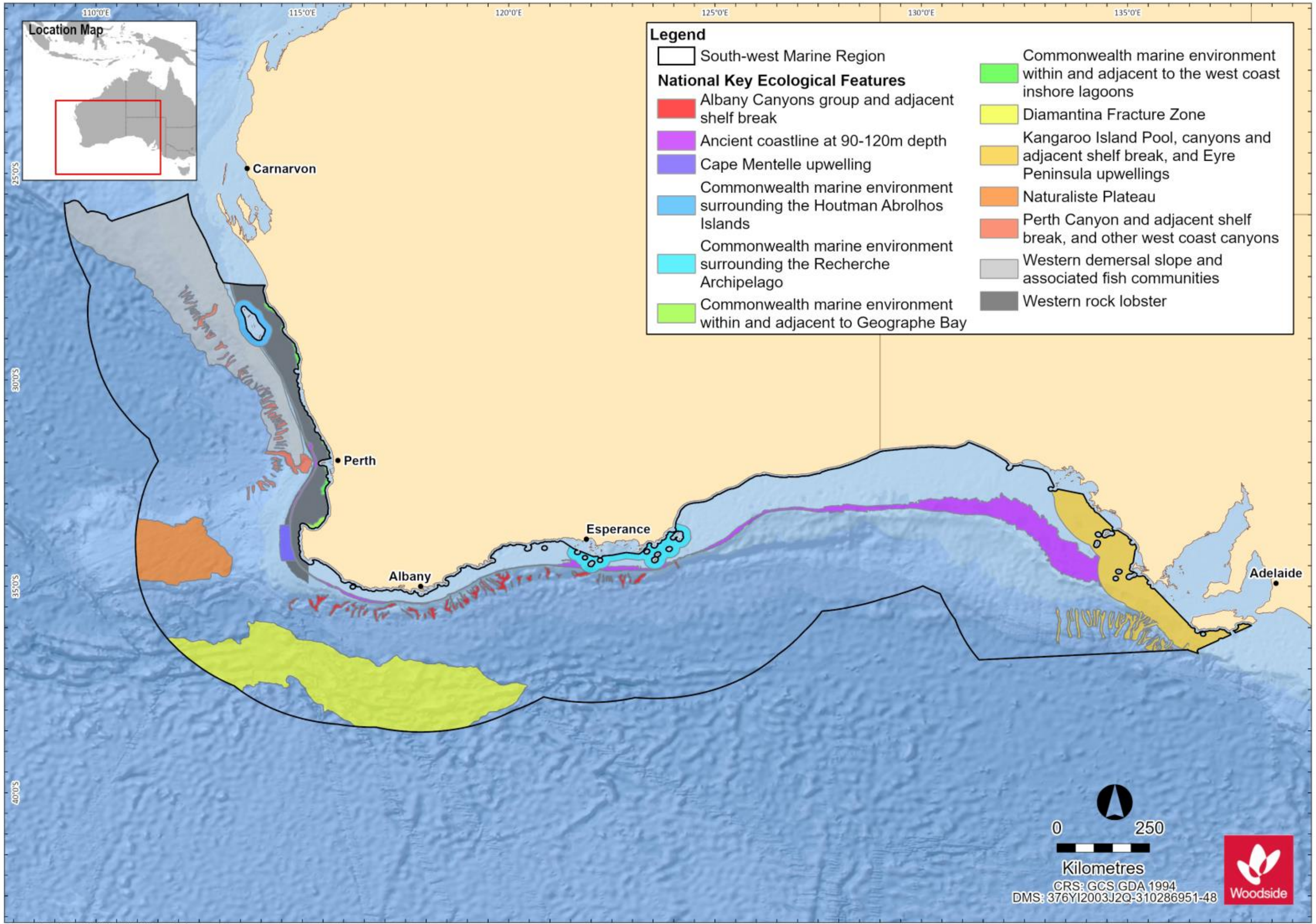

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Figure 9-2. Key Ecological Features (KEFs) within the SWMR

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Table 9-3 Key Ecological Features (KEF) within the NMR

KEF Name	Values[1]	Description
Carbonate bank and terrace system of the Van Diemen Rise	Important for its role in enhancing biodiversity and local productivity relative to its surrounds and for supporting relatively high species diversity The feature has been identified as a sponge biodiversity hotspot (Przeslawski *et al.* 2014)	The bank and terrace system of the Van Diemen Rise is part of the larger system associated with the Sahul Banks to the north and Londonderry Rise to the east; it is characterised by terrace, banks, channels and valleys. The variability in water depth and substrate composition may contribute to the presence of unique ecosystems in the channels. Species present include sponges, soft corals and other sessile filter feeders associated with hard substrate sediments of the deep channels; epifauna and infauna include polychaetes and ascidians. Olive ridley turtles, sea snakes and sharks are also found associated with this feature.
Gulf of Carpentaria basin	Regional importance for biodiversity, endemism and aggregations of marine life relevant to benthic and pelagic habitats	The Gulf of Carpentaria basin is one of the few remaining near-pristine marine environments in the world. Primary productivity in the Gulf of Carpentaria basin is mainly driven by cyanobacteria that fix nitrogen but is also strongly influenced by seasonal processes. The soft sediments of the basin are characterised by moderately abundant and diverse communities of infauna and mobile epifauna dominated by polychaetes, crustaceans, molluscs, and echinoderms. The basin also supports assemblages of pelagic fish species including planktivorous and schooling fish, with top predators such as shark, snapper, tuna, and mackerel.
Gulf of Carpentaria coastal zone	High productivity, aggregations of marine life (including several endemic species) and high biodiversity compared to broader region	Nutrient inflow from rivers adjacent to the NMR generates higher productivity and more diverse and abundant biota within the Gulf of Carpentaria coastal zone than elsewhere in the region. The coastal zone is near pristine and supports many protected species such as marine turtles, dugongs, and sawfishes. Ecosystem processes and connectivity remain intact; river flows are mostly uninterrupted by artificial barriers and healthy, diverse estuarine and coastal ecosystems support many species that move between freshwater and saltwater environments.
Pinnacles of the Bonaparte Basin	Unique seafloor feature with ecological properties of regional significance Provide areas of hard substrate in an otherwise soft sediment environment and so are important for sessile species Recognised as a biodiversity hotspot for sponges The Pinnacles of the Bonaparte Basin KEF is located within both the NWMR and NMR (refer **Table 9-1**)	Covering more than 520 km^2 within the Bonaparte Basin, this feature contains the largest concentration of pinnacles along the Australian margin. The Pinnacles of the Bonaparte Basin are thought to be the eroded remnants of underlying strata; it is likely that the vertical walls generate local upwelling of nutrient-rich water, leading to phytoplankton productivity that attracts aggregations of planktivorous and predatory fish, seabirds and foraging turtles.

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KEF Name	Values[1]	Description
Plateaux and saddle north-west of the Wellesley Islands	High species abundance, diversity and endemism of marine life	Abundance and species density are high in the plateaux and saddle as a result of increased biological productivity associated with habitats rather than currents. Submerged reefs support corals that are typical of northern Australia, including corals that have bleach-resistant zooxanthellae; and particular reef fish species that are different to those found elsewhere in the Gulf of Carpentaria. Species present include marine turtles and reef fish such as coral trout, cod, mackerel, and shark. Seabirds frequent the plateaux and saddle, most likely due to the presence of predictable food resources for feeding offspring.
Shelf break and slope of the Arafura Shelf	The Shelf break and slope of the Arafura Shelf is defined as a key ecological feature for its ecological significance associated with productivity emanating from the slope It also forms part of a unique biogeographic province (Last *et al.*, 2005)	The shelf break and slope of the Arafura Shelf is characterised by continental slope and patch reefs and hard substrate pinnacles. The ecosystem processes of the feature are largely unknown in the region; however, the Indonesian Throughflow and surface wind-driven circulation are likely to influence nutrients, pelagic dispersal and species and biological productivity in the region. Biota associated with the feature is largely of Timor–Indonesian Malay affinity.
Submerged coral reefs of the Gulf of Carpentaria	High aggregations of marine life, biodiversity and endemism Twenty per cent of the reefs found in the NMR are situated within this KEF (Harris *et al.*, 2007)	The submerged coral reefs of the Gulf of Carpentaria are characterised by submerged patch, platform and barrier reefs that form a broken margin around the perimeter of the Gulf of Carpentaria basin, rising from the sea floor at depths of 30–50 m. These reefs provide breeding and aggregation areas for many fish species including mackerel and snapper and offer refuges for sea snakes and apex predators such as sharks. Coral trout species that inhabit the submerged reefs are smaller than those found in the Great Barrier Reef and may prove to be an endemic sub-species.
Tributary Canyons of the Arafura Depression	High productivity and high levels of species diversity and endemism of marine life within the benthic and pelagic habitats of the feature	The tributary canyons are approximately 80–100 m deep and 20 km wide. The largest of the canyons extend some 400 km from Cape Wessel into the Arafura Depression, and are the remnants of a drowned river system that existed during the Pleistocene era. Sediments in this feature are mainly calcium-carbonate rich, although sediment type varies from sandy substrate to soft muddy sediments and hard, rocky substrate. Marine turtles, deep sea sponges, barnacles and stalked crinoids have all been identified in the area.

[1] *Values description sourced from Marine bioregional plan for the North Marine Region (DSEWPAC, 2012c) and Department of Agriculture, Water and the Environment (DAWE) SPRAT database.*

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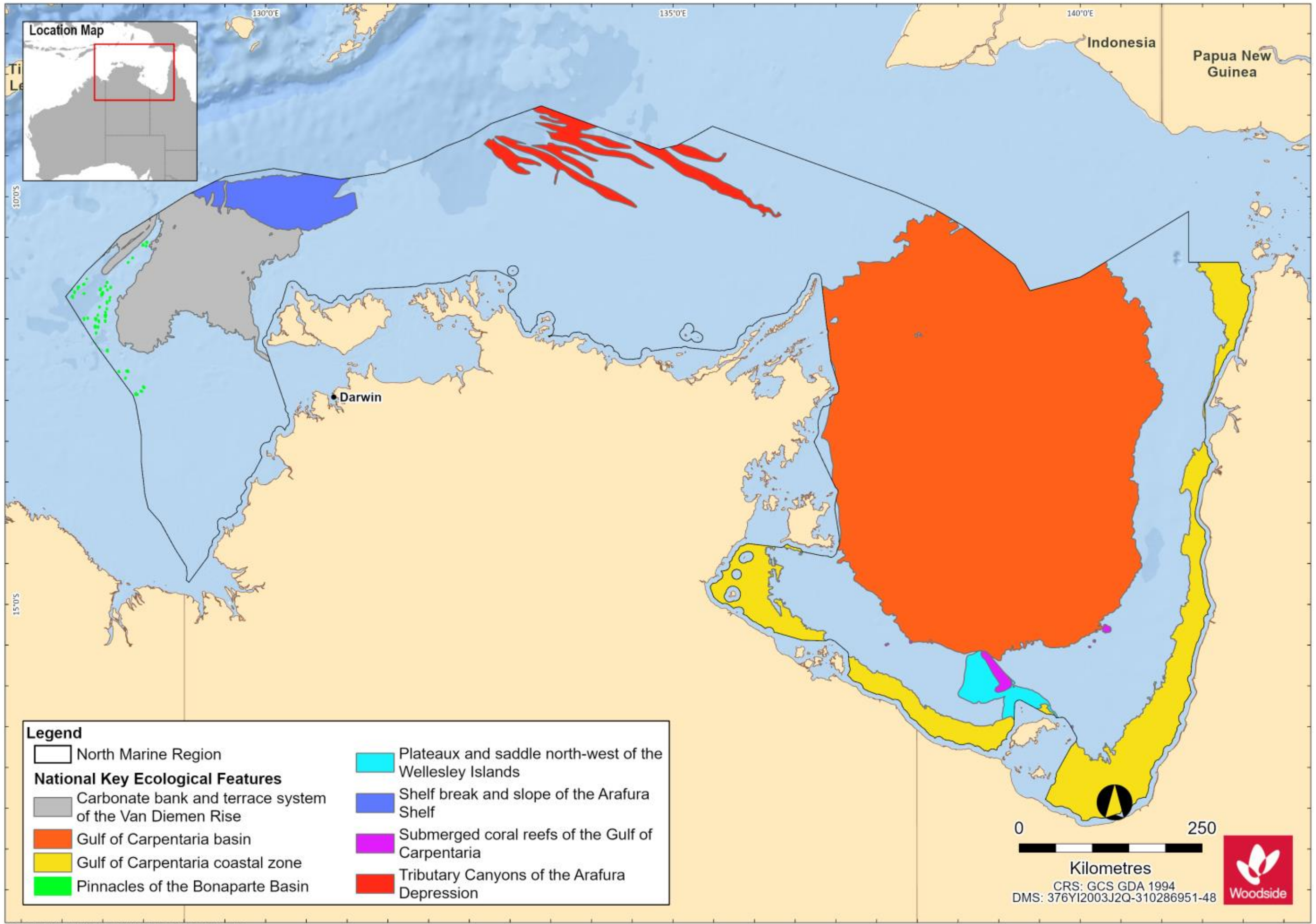

Basemap Esri, Garmin, GEBCO, NOAA NGDC, and other contributors

Figure 9-3. Key Ecological Features (KEFs) within the NMR

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10. PROTECTED AREAS

10.1 Regional Context

Protected areas included World Heritage Properties, National Heritage Places, Wetlands of International Importance, Australian Marine Parks, State Marine Parks and Reserves, Threatened Ecological Communities and the Australian Whale Sanctuary. The PMST Reports (**Appendix A**) shows that there are twenty-nine protected areas found in the NWMR, eighteen in the SWMR and nine in the NMR.

Table 10-1, Table 10-2 and **Table 10-3** outline the protected areas of each of the marine regions NWMR, SWMR and NMR, respectively.

10.2 World Heritage Properties

Properties nominated for World Heritage listing are inscribed on the list only after they have been carefully assessed as representing the best examples of the world's cultural and natural heritage. Only World Heritage listings classed as natural are discussed in this section. World Heritage sites classed as cultural are discussed in **Section 11**.

The list of Australia's World Heritage Properties and the PMST Reports (**Appendix A**) show two World Heritage Properties within the NWMR (**Table 10-1**), no World Heritage Properties within the SWMR (**Table 10-2),** and though not reported in the NMR PMST Report, Kakadu National Park and World Heritage Area is included in **Table 10-3**.

10.3 National and Commonwealth Heritage Places - Natural

The National Heritage List is Australia's list of natural, historic, and Indigenous places of outstanding significance to the nation. The National Heritage List Spatial Database describes the place name, class (Indigenous, natural, historic), and status. Commonwealth Heritage Places are a collection of sites recognised for their Indigenous, historical and/or natural values which are owned or controlled by the Australian Government.

Only National and Commonwealth Heritage Places classed as natural are discussed in this section. Heritage Places classed as indigenous or historic are discussed in **Section 11**.

A search of the National Heritage List Spatial Database and the PMST Reports (**Appendix A**) identified three natural National Heritage Places in the NWMR (**Table 10-1**), three in the SWMR (**Table 10-2**) and for the NMR, Kakadu National Park (not included in the PMST report) is included in **Table 10-3**.

A search of the Commonwealth Heritage List identified four natural commonwealth heritage places within the NWMR (**Table 10-1**).

10.4 Wetlands of International Importance (listed under the Ramsar Convention)

Australia has 65 Ramsar wetlands that cover >8.3 million ha. Ramsar wetlands are those that are representative, rare, or unique wetlands, or that are important for conserving biological diversity.

The List of Wetlands of International Importance held under the Ramsar Convention and the PMST Reports (**Appendix A**) identified four Ramsar Sites with coastal features within the NWMR (**Table 10-1**), four in the SWMR (**Table 10-2**) and two for the New Territory, included for the NMR (**Table 10-3**).

10.5 Australian Marine Parks

Australian Marine Parks (AMPs), proclaimed under the EPBC Act in 2007 and 2013, are located in Commonwealth waters that start at the outer edge of State and Territory waters, generally three

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nautical miles (~5.5 km) from the shore, and extend to the outer boundary of Australia’s EEZ, 200 nm (~370 km) from the shore.

PMST Reports (**Appendix A**) show sixteen AMPs within the NWMR (**Table 10-1**), ten within the SWMR (**Table 10-2**) and eight within the NMR (**Table 10-3**).

10.6 Threatened Ecological Communities

No Threatened Ecological Communities (TECs) as listed under the EPBC Act are known to occur within the marine waters of the NWMR, SWMR or NMR as indicated by the PMST Reports (**Appendix A**).

10.7 Australian Whale Sanctuary

The Australian Whale Sanctuary has been established to protect all whales and dolphins found in Australian waters. Under the EPBC Act all cetaceans (whales, dolphins and porpoises) are protected in Australian waters.

The Australian Whale Sanctuary includes all Commonwealth waters from the three nautical mile State/Territory waters limit out to the boundary of the EEZ (i.e. out to 200 nm and further in some places). Within the Sanctuary it is an offence to kill, injure or interfere with a cetacean. Severe penalties apply to anyone convicted of such offences.

10.8 State Marine Parks and Reserves

State Marine Parks and Reserves, proclaimed under the *Conservation and Land Management Act 1984* (CALM Act), are located in State waters and vested in the WA Conservation and Parks Commission. State Marine Parks and Reserves of Western Australia have been considered, with 14 occurring in the NWMR (**Table 10-1**) and six occurring in the SWMR (**Table 10-2**).

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10.9 Summary of Protected Areas within the NWMR

Table 10-1 Protected Areas within the NWMR

Protected Area	Woodside Activity Area			IUCN Protected Area Category* or Relevant Park Zone	Description	Conservation Values
	Browse	NWS/S	NW Cape			
World Heritage Properties						
Shark Bay World Heritage Property	-	-	✓		The Shark Bay World Heritage Property is adjacent to the Shark Bay AMP and was included on the World Heritage List in 1991.	Universal values of the Shark Bay World Heritage Property include large and diverse seagrass beds, stromatolites and populations of dugong and threatened species. Inscribed under Natural Criteria vii, viii, ix and x.
The Ningaloo Coast World Heritage Property	-	-	✓		The Ningaloo Coast World Heritage Property lies within the Ningaloo AMP and was included on the World Heritage List in 2011.	Universal values of the Ningaloo Coast World Heritage Property include high marine species diversity and abundance; in particular, Ningaloo Reef supports both tropical and temperate marine reptiles and mammals. Inscribed under Natural Criteria vii and x.
National Heritage Places - Natural						
Shark Bay	-	-	✓		The Shark Bay National Heritage Place consists of the same area included in the Shark Bay World Heritage Property (refer above) and was established on the National Heritage List in 2007.	The national heritage place has a number of exceptional natural features, including one of the largest and most diverse seagrass beds in the world, colonies of stromatolites and rich marine life including a large population of dugongs, and also provides a refuge for a number of other globally threatened species. Shark Bay meets the national heritage listing criteria a, b, c, d, e, f, g, h and i.
The Ningaloo Coast	-	-	✓		The Ningaloo Coast National Heritage Place consists of the same area included in the Ningaloo	The Ningaloo Coast contains one of the best developed near-shore reefs in the world, being home to rugged limestone peninsulas, spectacular coral and sponge gardens and the whale shark.

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Protected Area	Woodside Activity Area			IUCN Protected Area Category* or Relevant Park Zone	Description	Conservation Values
	Browse	NWS/S	NW Cape			
					Coast World Heritage Property (refer above) and was established on the National Heritage List in 2010.	The Ningaloo Coast meets the national heritage listing criteria a, b, c, d, and f.
The West Kimberley	✓	✓	-		The West Kimberley National Heritage Place covers an area of around 192,000 km^2 located in the north-west of Australia from Broome to Wyndham, and was established on the National Heritage List in 2011.	The Kimberley plateau, north-western coastline and northern rivers of the West Kimberley provide a vital refuge for many native plants and animals that are found nowhere else or which have disappeared from much of the rest of Australia. In addition, Roebuck Bay is internationally recognised as one of Australia’s most significant sites for migratory wading birds. The national heritage place also contains a remarkable history of Aboriginal occupation, with many places of indigenous sacred value. The West Kimberley meets the national heritage listing criteria a, b, c, d, e, f, g, h and i.
Commonwealth Heritage Places - Natural						
Mermaid Reef – Rowley Shoals	-	✓	-	N/A	The Mermaid Reef – Rowley Shoals Commonwealth Heritage Place is located within the boundary of the Mermaid Reef Marine National Nature Reserve. The site was listed as a Commonwealth Heritage Place in 2004.	The Mermaid Reef-Rowley Shoals Commonwealth Heritage Place is regionally important for the diversity of its fauna and together with Clerke and Imperieuse reefs, has biogeographical significance due to the presence of species which are at, or close to, the limits of their geographic ranges, including fishes known previously only from Indonesian waters. Rowley Shoals is important for benchmark studies as one of the few places off the north-west coast of Western Australia which have been the site of major biological collection trips by the WA Museum.

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Protected Area	Woodside Activity Area			IUCN Protected Area Category* or Relevant Park Zone	Description	Conservation Values
	Browse	NWS/S	NW Cape			
Ashmore Reef National Nature Reserve	✓	-	-		The Ashmore Reef Commonwealth Heritage Place is located within the boundary of the Ashmore Reef Marine Park (refer AMPs below). The site was listed as a Commonwealth Heritage Place in 2004.	Ashmore Reef has major significance as a staging point for wading birds migrating between Australia and the Northern Hemisphere and supports high concentrations of breeding seabirds, many of which are nomadic and typically breed on small isolated islands. Ashmore Reef is an important scientific reference area for migratory seabirds, sea snakes and marine invertebrates. The Ashmore Reef Commonwealth Heritage Place is significant for its history of human occupation and use. The island is believed to have been visited by Indonesian fisherman since the early eighteenth century. The islands were used both for fishing and as a staging point for voyages to the southern reefs off Australia's coast.
Scott Reef and Surrounds – Commonwealth Area	✓	-	-		Scott Reef and Surrounds Commonwealth Heritage Place is located within the Western Australian Coastal Waters surrounding North and South Scott Reef. The site was listed as a Commonwealth Heritage Place in 2004.	The Scott Reef and Surrounds Commonwealth Heritage Place is regionally important for the diversity of its fauna and has biogeographical significance due to the presence of species which are at, or close to, the limits of their geographic ranges, including fish known previously only from Indonesian waters. Scott Reef is recognised as important for scientific research and benchmark studies due to its age, the extensive documentation of its geophysical and physical environmental characteristics and its use as a site of major biological collection trips and surveys by the WA Museum and the Australian Institute of Marine Science.

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Protected Area	Woodside Activity Area			IUCN Protected Area Category* or Relevant Park Zone	Description	Conservation Values
	Browse	NWS/S	NW Cape			
Ningaloo Marine Area – Commonwealth Waters	-	-	✓		The Ningaloo Marine Area Commonwealth Heritage Place is located within the Commonwealth waters of the Ningaloo Marine Park (refer AMPs below). The site was listed as a Commonwealth Heritage Place in 2004.	The Ningaloo Marine Area Commonwealth Heritage Place provides a migratory pathway for humpback whales and foraging habitat for whale sharks. The place is an important breeding area for billfish and manta ray. The Ningaloo Marine Area provides opportunities for scientific research relating to aspects of the area's unique features including tourism (marine ecology, whales, turtles, whale sharks, fish and oceanography.
Wetlands of International Importance (Ramsar)						
Ashmore Reef National Nature Reserve	✓	-	-	Ramsar	The Ashmore Reef Ramsar site is located within the boundary of the Ashmore Reef Marine Park (refer AMPs below). The site was listed under the Ramsar Convention in 2002.	Ashmore Reef Ramsar site supports internationally significant populations of seabirds and shorebirds, is important for turtles (green, hawksbill and loggerhead) and dugong, and has the highest diversity of hermatypic (reef-building) corals on the WA coast. It is known for its abundance and diversity of sea snakes. However, since 1998 populations of sea snakes at Ashmore Reef have been in decline.
Eighty Mile Beach	-	✓	-	Ramsar	The Eighty Mile Beach Ramsar site covers an area of 1250 km^2, located along a long section of the Western Australian coastline adjacent to the Eighty Mile Beach AMP (refer below).	The Eighty Mile Beach Ramsar site includes saltmarsh and a raised peat bog more than 7000 years old. The site contains the most important wetland for waders in north-western Australia, supporting up to 336,000 birds, and is especially important as a land fall for waders migrating south for the austral summer.
Roebuck Bay	-	✓	-	Ramsar	The Roebuck Bay Ramsar site covers an area of 550	The Roebuck Bay Ramsar site is recognised as one of the most important areas for migratory shorebirds in Australia.

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Protected Area	Woodside Activity Area			IUCN Protected Area Category* or Relevant Park Zone	Description	Conservation Values
	Browse	NWS/S	NW Cape			
					km^2, located south of Broome and adjacent to the Roebuck AMP (refer below).	The site regularly supports over 100,000 waterbirds, with numbers being highest in the austral spring when migrant species breeding in the Palearctic stop to feed during migration.
Ord River Floodplain	✓			Ramsar	The Ord River Floodplain Ramsar Site is in the East Kimberley region and encompasses an extensive system of river, seasonal creek, tidal mudflat, and floodplain wetlands. The Ramsar Site is a nursery, feeding and/or breeding ground for migratory birds, waterbirds, fish, crabs, prawns, and crocodiles.	The site represents the best example of wetlands associated with the floodplain and estuary of a tropical river system in the Tanami-Timor Sea Coast Bioregion in the Kimberley. In addition, the False Mouths of the Ord are the most extensive mudflat and tidal waterway complex in Western Australia.
Wetlands of National Importance (DAWE, 2019)						
Ashmore Reef	✓	-	-		Ashmore Reef is a shelf-edge platform reef located among the Sahul Banks of north-western Australia. It covers an area of 583 km^2 and consists of three islets surrounded by intertidal reef and sand flats.	These islets are major seabird nesting sites with 20 breeding species recorded to date. The total bird population has been estimated to exceed 100,000 during the peak breeding season. The marine reserve also has the highest diversity of marine fauna of the reefs on the NWS and differs from other reefs and coastal areas in the region. The area meets criteria 1, 3, 4 and 5 for inclusion on the Directory of Important Wetlands in Australia.
Mermaid Reef	-	✓	-		Mermaid Reef Marine Park covers an area of around 540 km^2, located ~280 km west north-west of Broome, and is the most north-easterly atoll of the Rowley Shoals.	The reefs of the Mermaid Reef Marine Park have biogeographic value due to the presence of species that are at or close to the limit of their distribution. The coral communities are one of the special values of Mermaid Reef. The area meets criteria 1, 2 and 3 for inclusion on the Directory of Important Wetlands in Australia.

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Protected Area	Woodside Activity Area			IUCN Protected Area Category* or Relevant Park Zone	Description	Conservation Values
	Browse	NWS/S	NW Cape			
Exmouth Gulf East	-	-	✓		Exmouth Gulf East covers an area of 800 km^2 and includes wetlands in the eastern part of Exmouth Gulf, from Giralia Bay; to Urala Creek, Locker Point.	The Exmouth Gulf East is an outstanding example of tidal wetland systems of low coast of north-west Australia, with well- developed tidal creeks, extensive mangrove swamps and broad saline coastal flats. The site is one of the major population centres for dugong in WA and its seagrass beds and extensive mangroves provide nursery and feeding areas for marine fishes and crustaceans in the Gulf. The area meets criteria 1, 2 and 3 for inclusion on the Directory of Important Wetlands in Australia.
Hamelin Pool	-	-	✓		Hamelin Pool covers an area of 900 km^2 in the far south-east part of Shark Bay.	Hamelin Pool is an outstanding example of a hypersaline marine embayment and supports extensive microbialite (subtidal stromatolite) formations, which are the most abundant and diverse examples of growing marine microbialites in the world. The area meets criteria 1 and 6 for inclusion on the Directory of Important Wetlands in Australia.
Shark Bay East	-	-	✓		Shark Bay East covers a 250 km area of coastline comprising tidal wetlands, and marine waters less than 6 m deep at low tide, in the east arm of Shark Bay.	The site is an outstanding example of a very large, shallow marine embayment, with particularly extensive occurrence of seagrass beds and substantial areas of intertidal mud/sandflats and mangrove swamp. The site supports what is probably the world's largest discrete population of dugong; it is also a major nursery and/or feeding area for turtles, rays, sharks, other fishes, prawns and other marine fauna; and is a major migration stop-over area for shorebirds. The area meets criteria 1, 2, 3, 4, 5 and 6 for inclusion on the Directory of Important Wetlands in Australia.
Australian Marine Parks (DNP, 2018a)						
Abrolhos Marine Park	-	-	✓	II, IV, VI	Abrolhos Marine Park is located adjacent to the WA Houtman Abrolhos Islands, covering a large offshore	Abrolhos Marine Park is significant because it contains habitats, species and ecological communities associated with four bioregions:

Protected Area	Woodside Activity Area			IUCN Protected Area Category* or Relevant Park Zone	Description	Conservation Values
	Browse	NWS/S	NW Cape			
					area of 88,060 km^2 extending from the WA State waters boundary to the edge of Australia's EEZ. The Abrolhos Marine Park is located within both the NWMR and SWMR.	• Central Western Province • Central Western Shelf Province • Central Western Transition • South-west Shelf Transition It includes seven KEFs: Commonwealth marine environment surrounding the Houtman Abrolhos Islands; Demersal slope and associated fish communities of the Central Western Province; Mesoscale eddies; Perth Canyon and adjacent shelf break, and other west-coast canyons; Western rock lobster; Ancient coastline at 90-120 m depth; and Wallaby Saddle. The AMP supports a range of species including species listed as threatened, migratory, marine or cetacean under the EPBC Act. BIAs within the AMP include foraging and breeding habitat for seabirds, foraging habitat for Australian sea lions and white sharks, and a migratory pathway for humpback and pygmy blue whales. The AMP is adjacent to the northernmost Australian sea lion breeding colony in Australia on the Houtman Abrolhos Islands.
Carnarvon Canyon Marine Park	-	-	✓	IV	Carnarvon Canyon Marine Park covers an area of 6177 km^2, located ~300 km north-west of Carnarvon.	Carnarvon Canyon Marine Park is significant because it contains habitats, species and ecological communities associated with the Central Western Transition bioregion. The AMP supports a range of species, including species listed as threatened, migratory, marine or cetacean under the EPBC Act. There is limited information about species' use of this AMP.
Shark Bay Marine Park	-	-	✓	VI	Shark Bay Marine Park covers an area of 7443 km^2 located ~60 km offshore of Carnarvon, adjacent to the Shark Bay World Heritage Property and National Heritage Place.	Shark Bay Marine Park is significant because it contains habitats, species and ecological communities associated with two bioregions: • Central Western Shelf Province • Central Western Transition. The AMP supports a range of species including species listed as threatened, migratory, marine or cetacean under

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Protected Area	Woodside Activity Area			IUCN Protected Area Category* or Relevant Park Zone	Description	Conservation Values
	Browse	NWS/S	NW Cape			
						the EPBC Act. BIAs within the AMP include breeding habitat for seabirds, internesting habitat for marine turtles, and a migratory pathway for humpback whales.
Gascoyne Marine Park	-	-	✓	II, IV, VI	Gascoyne Marine Park covers an area of 81,766 km^2, located ~20 km off the west coast of the Cape Range Peninsula, adjacent to the Ningaloo Marine Park.	Gascoyne Marine Park is significant because it contains habitats, species and ecological communities associated with three bioregions: • Central Western Shelf Transition • Central Western Transition • Northwest Province. It includes four KEFs: Canyons linking the Cuvier Abyssal Plain and the Cape Range Peninsula; Commonwealth waters adjacent to Ningaloo Reef; Continental slope demersal fish communities; and Exmouth Plateau. The AMP supports a range of species including species listed as threatened, migratory, marine or cetacean under the EPBC Act. BIAs within the AMP include breeding habitat for seabirds, internesting habitat for marine turtles, a migratory pathway for humpback whales, and foraging habitat and migratory pathway for pygmy blue whales.
Ningaloo Marine Park	-	-	✓	II, IV	Ningaloo Marine Park covers an area of 2435 km^2, stretching ~300 km along the west coast of the Cape Range Peninsula, and is adjacent to the WA Ningaloo Marine Park and Gascoyne Marine Park.	Ningaloo Marine Park is significant because it contains habitats, species and ecological communities associated with four bioregions: • Central Western Shelf Transition • Central Western Transition • Northwest Province • Northwest Shelf Province. It includes three KEFs: Canyons linking the Cuvier Abyssal Plain and the Cape Range Peninsula; Commonwealth waters adjacent to Ningaloo Reef; and Continental slope demersal fish communities. The AMP supports a range of species including species listed as threatened, migratory, marine or cetacean under the EPBC Act. BIAs within the AMP include breeding and

Protected Area	Woodside Activity Area			IUCN Protected Area Category* or Relevant Park Zone	Description	Conservation Values
	Browse	NWS/S	NW Cape			
						or foraging habitat for seabirds, internesting habitat for marine turtles, a migratory pathway for humpback whales, foraging habitat and migratory pathway for pygmy blue whales, breeding, calving, foraging and nursing habitat for dugong and foraging habitat for whale sharks.
Montebello Marine Park	-	✓	-	VI	Montebello Marine Park covers an area of 3413 km^2, located offshore of Barrow Island and 80 km west of Dampier extending from the WA State waters boundary, and is adjacent to the WA Barrow Island and Montebello Islands Marine Parks.	Montebello Marine Park is significant because it contains habitats, species and ecological communities associated with the Northwest Shelf Province bioregion. It includes one KEF: Ancient coastline at 125 m depth contour. The AMP supports a range of species including species listed as threatened, migratory, marine or cetacean under the EPBC Act. BIAs within the AMP include breeding habitat for seabirds, internesting, foraging, mating, and nesting habitat for marine turtles, a migratory pathway for humpback whales and foraging habitat for whale sharks.
Dampier Marine Park	-	✓	-	II, IV, VI	Dampier Marine Park covers an area of 1252 km^2, located ~10 km north-east of Cape Lambert and 40 km from Dampier extending from the WA State waters boundary.	Dampier Marine Park is significant because it contains habitats, species and ecological communities associated with the Northwest Shelf Province bioregion. The AMP provides protection for offshore shelf habitats adjacent to the Dampier Archipelago, and the area between Dampier and Port Hedland, and is a hotspot for sponge biodiversity. The AMP supports a range of species including those listed as threatened, migratory, marine or cetacean under the EPBC Act. BIAs within the AMP include breeding and foraging habitat for seabirds, internesting habitat for marine turtles and a migratory pathway for humpback whales.
Eighty Mile Beach Marine Park	-	✓	-	VI	Eighty Mile Beach Marine Park covers an area of 10,785 km^2, located ~74 km north-east of Port Hedland, adjacent to the	Eighty Mile Beach Marine Park is significant because it contains habitats, species and ecological communities associated with the Northwest Shelf Province and consists of shallow shelf habitats, including terrace, banks and shoals.

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Protected Area	Woodside Activity Area			IUCN Protected Area Category* or Relevant Park Zone	Description	Conservation Values
	Browse	NWS/S	NW Cape			
					WA Eighty Mile Beach Marine Park.	The AMP supports a range of species including species listed as threatened, migratory, marine or cetacean under the EPBC Act. BIAs within the AMP include breeding, foraging and resting habitat for seabirds, internesting and nesting habitat for marine turtles, foraging, nursing and pupping habitat for sawfishes and a migratory pathway for humpback whales.
Argo – Rowley Terrace Marine Park	✓	✓	-	II, VI, VI (Trawl)	Argo-Rowley Terrace Marine Park covers an area of 146,003 km^2, located ~270 km north-west of Broome, and extends to the limit of Australia's EEZ. The AMP is adjacent to the Mermaid Reef Marine Park and the WA Rowley Shoals Marine Park.	Argo–Rowley Marine Park is significant because it contains habitats, species and ecological communities associated with two bioregions: • Northwest Transition • Timor Province. It includes two KEFs: Canyons linking the Argo Abyssal Plain with the Scott Plateau; and Mermaid Reef and Commonwealth waters surrounding Rowley Shoals. The AMP supports a range of species including species listed as threatened, migratory, marine or cetacean under the EPBC Act. BIAs within the AMP include resting and breeding habitat for seabirds and a migratory pathway for the pygmy blue whale.
Mermaid Reef Marine Park	-	✓	-	II	Mermaid Reef Marine Park covers an area of 540 km^2, located ~280 km north-west of Broome, adjacent to the Argo–Rowley Terrace Marine Park and ~13 km from the WA Rowley Shoals Marine Park. Mermaid Reef is one of three reefs forming the Rowley Shoals. The other two are Clerke Reef and Imperieuse Reef, to the	Mermaid Reef Marine Park is significant because it contains habitats, species and ecological communities associated with the Northwest Transition. It includes one KEF: Mermaid Reef and Commonwealth waters surrounding Rowley Shoals. The Rowley Shoals have been described as the best geological examples of shelf atolls in Australian waters. The AMP supports a range of species, including species listed as threatened, migratory, marine or cetacean under the EPBC Act. BIAs within the AMP include breeding habitat for seabirds and a migratory pathway for the pygmy blue whale.

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Protected Area	Woodside Activity Area			IUCN Protected Area Category* or Relevant Park Zone	Description	Conservation Values
	Browse	NWS/S	NW Cape			
					south-west of the AMP, which are included in the WA Rowley Shoals Marine Park.	
Roebuck Marine Park	-	✓	-	VI	Roebuck Marine Park covers an area of 304 km^2, located ~12 km offshore of Broome, and is adjacent to the WA Yawuru Nagulagun/Roebuck Bay Marine Park.	Roebuck Marine Park is significant because it contains habitats, species and ecological communities associated with the Northwest Shelf Province and consists entirely of shallow continental shelf habitat. The AMP supports a range of species including species listed as threatened, migratory, marine or cetacean under the EPBC Act. BIAs within the AMP include breeding and resting habitat for seabirds, foraging and internesting habitat for marine turtles, a migratory pathway for humpback whales and foraging habitat for dugong.
Kimberley Marine Park	✓	✓	-	II, IV, VI	Kimberley Marine Park covers an area of 74,469 km^2, located ~100 km north of Broome, extending from the WA State waters boundary north from the Lacepede Islands to the Holothuria Banks offshore from Cape Bougainville.	Kimberley Marine Park is significant because it includes habitats, species and ecological communities associated with three bioregions: • Northwest Shelf Province • Northwest Shelf Transition • Timor Province. It includes two KEFs: Ancient coastline at 125 m depth contour; and Continental slope demersal fish communities. The AMP supports a range of species, including protected species listed as threatened, migratory, marine or cetacean under the EPBC Act. BIAs within the AMP include breeding and foraging habitat for seabirds, internesting and nesting habitat for marine turtles, breeding, calving and foraging habitat for inshore dolphins, calving, migratory pathway and nursing habitat for humpback whales, migratory pathway for pygmy blue whales, foraging habitat for dugong and foraging habitat for whale sharks.
Ashmore Reef Marine Park	✓	-	-	Ia, IV	Ashmore Reef Marine Park covers an area of 583 km^2, located ~630 km north of	Ashmore Reef Marine Park is significant because it includes habitats, species and ecological communities associated with the Timor Province. It includes two KEFs:

Protected Area	Woodside Activity Area			IUCN Protected Area Category* or Relevant Park Zone	Description	Conservation Values
	Browse	NWS/S	NW Cape			
					Broome and 110 km south of the Indonesian island of Roti. The AMP is located in Australia's External Territory of Ashmore and Cartier Islands and is within an area subject to a Memorandum of Understanding (MoU) between Indonesia and Australia, known as the MoU Box.	Ashmore Reef and Cartier Island and surrounding Commonwealth waters; and Continental slope demersal fish communities. The AMP supports a range of species, including species listed as threatened, migratory, marine or cetacean under the EPBC Act. BIAs within the AMP include breeding, foraging and resting habitat for seabirds, resting and foraging habitat for migratory shorebirds, foraging, mating, nesting and internesting habitat for marine turtles, foraging habitat for dugong, and a migratory pathway for pygmy blue whales.
Cartier Island Marine Park	✓	-	-	Ia	Cartier Island Marine Park covers an area of 172 km^2, located ~45 km south-east of Ashmore Reef Marine Park and 610 km north of Broome. It is also located in Australia's External Territory of Ashmore and Cartier Islands and within an area subject to an MoU between Indonesia and Australia, known as the MoU Box.	Cartier Island Marine Park is significant because it includes habitats, species and ecological communities associated with the Timor Province. It includes two key ecological features: Ashmore Reef and Cartier Island and surrounding Commonwealth waters and continental slope demersal fish communities. The AMP supports a range of species, including species listed as threatened, migratory, marine or cetacean under the EPBC Act. BIAs within the AMP include breeding and foraging habitat for seabirds, internesting, nesting and foraging habitat for marine turtles and foraging habitat for whale sharks. The AMP is also internationally significant for its abundance and diversity of sea snakes, some of which are listed species under the EPBC Act.
Joseph Bonaparte Gulf Marine Park	✓	-	-	VI	Joseph Bonaparte Gulf Marine Park covers an area of 8597 km^2 and is located ~15 km west of Wadeye, NT, and ~90 km north of Wyndham, WA, in the Joseph Bonaparte Gulf.	Joseph Bonaparte Gulf Marine Park is significant because it contains habitats, species and ecological communities associated with the Northwest Shelf Transition bioregion. It includes one KEF: Carbonate bank and terrace system of the Sahul Shelf. The AMP supports a range of species, including species listed as threatened, migratory, marine or cetacean under

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Protected Area	Woodside Activity Area			IUCN Protected Area Category* or Relevant Park Zone	Description	Conservation Values
	Browse	NWS/S	NW Cape			
					It is adjacent to the WA North Kimberley Marine Park. The Joseph Bonaparte Gulf Marine Park is located within both the NWMR and NMR.	the EPBC Act. BIAs within the AMP include foraging habitat for marine turtles and the Australian snubfin dolphin.
Oceanic Shoals Marine Park	✓	-	-	II, IV, VI	Oceanic Shoals Marine Park covers an area of 71,743 km^2 and is located west of the Tiwi Islands, ~155 km north-west of Darwin, NT and 305 km north of Wyndham, WA. The Oceanic Shoals Marine Park is located within both the NWMR and NMR.	Oceanic Shoals Marine Park is significant because it contains habitats, species and ecological communities associated with the Northwest Shelf Transition bioregion. It contains four KEFs: Carbonate bank and terrace systems of the Van Diemen Rise; Carbonate bank and terrace systems of the Sahul Shelf; Pinnacles of the Bonaparte Basin; and Shelf break and slope of the Arafura Shelf. The AMP supports a range of species, including species listed as threatened, migratory, marine or cetacean under the EPBC Act. BIAs within the AMP include foraging and internesting habitat for marine turtles.
State Marine Parks and Reserves						
North Kimberley Marine Park	✓	-	-	Sanctuary, Special Purpose and General Use Zones	The North Kimberley Marine Park covers approx. 18,450 km^2 with its south-western boundary located ~270 km north-east of Derby.	The coral reefs of the north Kimberley have the greatest diversity in Western Australia and are some of the most pristine and remarkable reefs in the world. The park surrounds more than 1000 islands and is home to listed species such as dugongs, marine turtles, and sawfishes (DPAW, 2016a).
Lalang-garram / Horizontal Falls Marine Park and North Lalang-garram Marine Park (jointly managed)	✓	-	-	Sanctuary, Special Purpose and General Use Zones	The Lalang-garram / Horizontal Falls Marine Park covers ~3530 km^2 from Talbot Bay in the west and Glenelg River in the east. The North Lalang-garram Marine Park covers ~1100	The Lalang-garram / Horizontal Falls Marine Park's most celebrated attraction is created by massive tides of up to 10 m and narrow gaps in two parallel tongues of land meaning the tide falls faster than the water can escape, producing 'horizontal falls'. There are also islands with fringing coral reefs and mangrove-lined creeks and bays. The North Lalang-garram Marine Park has a number of islands fringed with coral reef and has been identified as an

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Protected Area	Woodside Activity Area			IUCN Protected Area Category* or Relevant Park Zone	Description	Conservation Values
	Browse	NWS/S	NW Cape			
					km^2 between Camden Sound and North Kimberley Marine Parks.	ecological hotspot and supports more than 1% of the world's population of brown boobies, with up to 2000 breeding pairs. About 500 pairs of crested terns also nest on the island (DPAW, 2016b).
Lalang-garram / Camden Sound Marine Park	✓	-	-	Sanctuary, Special Purpose and General Use Zones	Lalang-garram / Camden Sound Marine Park covers 7050 km^2 located about 150 km north of Derby.	The Lalang-garram / Camden Sound Marine Park is the most important humpback whale nursery in the Southern Hemisphere. It also features the spectacular coastal Montgomery Reef. The marine park is home to six species of threatened marine turtle. Australian snubfin and Indo-Pacific humpback dolphins, dugongs, saltwater crocodiles, and several species of sawfish (DPAW, 2013).
Rowley Shoals Marine Park	-	✓	-	Sanctuary, Recreation and General Use Zones	The Rowley Shoals comprise of three reef systems, Mermaid Reef, Clerke Reef and Imperieuse Reef, all 30-40 km apart. These reef systems are located ~300 km west north-west of Broome.	The three coral atolls of the Rowley Shoals Marine Park comprise of shallow lagoons inhabited by diverse corals and abundant marine life, each covering around 80 km^2 at the edge of Australia's continental shelf. Further offshore, the seafloor slopes away to the abyssal plain, some 6000 m below. Undersea canyons slice the slope; these features are commonly associated with diverse communities of deep-water corals and sponges and create localised upwellings that aggregate pelagic species like tunas and billfish (DEC, 2007a).
Yawuru Nagulagun / Roebuck Bay Marine Park	-	✓	-	Special Purpose Zone	Yawuru Nagulagun / Roebuck Bay Marine Park is a series of intertidal flats lying on the coast to the south-east of Broome.	Roebuck Bay is an internationally significant wetland and one of the most important feeding grounds for migratory shorebirds in Australia. Australian snubfin and Australian humpback dolphins frequent the waters and humpback whales pass through on their annual migration. Flatback turtles nest on the shores and are found in the bay's waters with other sea turtle species. Seagrass and macroalgae communities provide food for protected species such as the dugong and flatback turtle (DPAW, 2016c).
Eighty Mile Beach Marine Park	-	✓	-	Sanctuary, Recreation, Special	Eighty Mile Beach Marine Park covers ~2000 km^2 stretching across 220km of	Eighty Mile Beach Marine Park is one of the world's most important feeding grounds for small wading birds that migrate to the area each summer, travelling from countries

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Protected Area	Woodside Activity Area			IUCN Protected Area Category* or Relevant Park Zone	Description	Conservation Values
	Browse	NWS/S	NW Cape			
				Purpose and General Use Zones	coastline between Port Hedland and Broome.	thousands of kilometres away. The marine park is a major nesting area for flatback turtles which are found only in northern Australia. Sawfishes, dugongs, dolphins and millions of invertebrates inhabit the sand and mud flats, seagrass meadows, coral reefs and mangroves (DPAW, 2014).
Montebello Islands Marine Park, Barrow Island Marine Park and Barrow Island Marine Management Area (jointly managed)	-	✓	-	Sanctuary, Recreation, General Use and Special Purpose Zones	The Montebello Islands Marine Park, Barrow Island Marine Park and Barrow Island Marine Management Area are located off the north-west coast of WA, ~1600 km north of Perth, and cover areas of ~583 km^2, 42 km^2 and 1,147 km^2, respectively.	The Montebello/Barrow islands marine conservation reserves have very complex seabed and island topography, resulting in a myriad of different habitats subtidal coral reefs, macroalgal and seagrass communities, subtidal soft-bottom communities, rocky shores and intertidal reef platforms, which support a rich diversity of invertebrates and finfish. The reserves are important breeding areas for several species of marine turtles and seabirds, which use the undisturbed sandy beaches for nesting. Humpback whales migrate through the reserves and dugongs occur in the shallow warm waters (DEC, 2007b).
Ningaloo Marine Park and Muiron Islands Marine Management Area (jointly managed)	-	-	✓	Sanctuary, Recreation, General Use and Special Purpose Zones	The Ningaloo Marine Park and Muiron Islands Marine Management Area are located off the North-west Cape of WA, ~1200 km north of Perth, and cover areas of ~2633 km^2 and 286 km^2, respectively.	Ningaloo Reef is the largest fringing coral reef in Australia. Temperate and tropical currents converge in the Ningaloo region resulting in highly diverse marine life including spectacular coral reefs, abundant fishes and species with special conservation significance such as turtles, whale sharks, dugongs, whales and dolphins. The region has diverse marine communities including mangroves, algae and filter-feeding communities and has high water quality. These values contribute to the Ningaloo Marine Park being regarded as the State's premier marine conservation icon. The Muiron Islands Marine Management Area is also important, containing a very diverse marine environment, with coral reefs, filter-feeding communities and macroalgal beds. In addition, the Islands are important seabird and green turtle nesting areas. (CALM, 2005a).

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Protected Area	Woodside Activity Area			IUCN Protected Area Category* or Relevant Park Zone	Description	Conservation Values
	Browse	NWS/S	NW Cape			
Shark Bay Marine Park and Hamelin Pool Marine Nature Reserve (jointly managed)	-	-	✓	Sanctuary, Recreation, General Use and Special Purpose Zones	The Shark Bay Marine Park and Hamelin Pool Marine Nature Reserves are located 400 km north of Geraldton, covering areas of ~7487 km^2 and 1270 km^2, respectively.	Seagrass covers over 4000 km^2 of the Shark Bay Marine Park, with 12 different species making it one of the most diverse seagrass assemblages in the world. Dugongs regularly use this habitat, with the bay containing one of the largest dugong populations in the world. Humpback whales also use the bay as a staging post in their migration along the coast. Green and loggerhead turtles occur in the bay with Dirk Hartog Island providing the most important nesting site for loggerheads in Western Australia. Hamelin Pool contains the most diverse and abundant examples of stromatolites found in the world. These are living representatives of stromatolites that existed some 3500 million years ago (CALM, 1996).

**Conservation objectives for IUCN categories include:*

Ia: Strict Nature Reserve

Ib: Wilderness Area

II: national Park

III: Natural Monument or Feature

IV: Habitat/Species Management Area

V: Protected Landscape

VI: Protected area with sustainable use of natural resources – allow human use but prohibits large scale development.

IUCN categories for the marine park are provided and, in brackets, the IUCN categories for specific zones within each Marine Park as assigned under the North-west Marine Parks Network Management Plan 2018 (DNP, 2018a)

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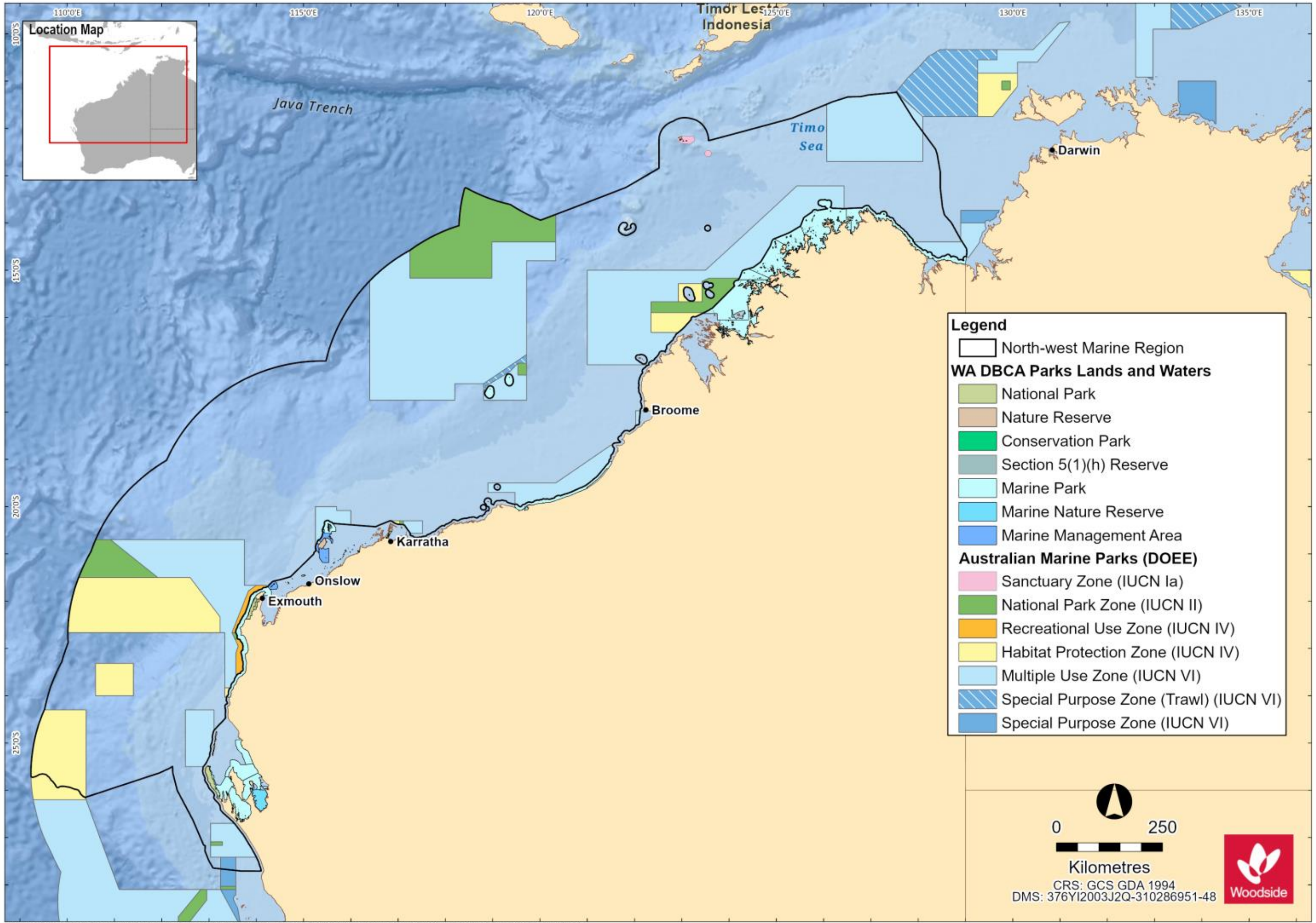

Basemap Sources: Esri, HERE, Garmin, GEBCO, National Geographic, NOAA, and the GIS User Community, Esri, Garmin, GEBCO, NOAA NGDC, and other contributors

Figure 10-1 Commonwealth and State Marine Protected Areas for the NWMR

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10.10 Summary of Protected Areas within the SWMR

Table 10-2 Protected Areas within the SWMR

Protected Area	IUCN Protected Area Category* or Relevant Park Zone	Description	Conservation Values
World Heritage Properties			
N/A			
National Heritage Places - Natural			
N/A			
Commonwealth Heritage Places - Natural			
N/A			
Wetlands of International Importance (Ramsar)			
Beecher Point Wetlands	Ramsar	Beecher Point Wetlands is a system of about sixty small wetlands located near Rockingham in south-west WA, covering an area of around 7 km^2. The site was listed under the Ramsar Convention in 2001.	The wetlands support sedgelands, herblands, grasslands, open-shrublands and low open-forests. The sedgelands that occur within the linear wetland depressions of the Ramsar site are a nationally listed TEC. At least four species of amphibians and twenty-one (21) species of reptiles have been recorded on the site. The site also supports the southern brown bandicoot. The site meets criteria 1 and 2 of the Ramsar Convention.
Forrestdale and Thomsons Lakes	Ramsar	Forrestdale Lake is located in the City of Armadale and Thomsons Lake is located in the City of Cockburn both of which lie within the southern Perth metropolitan area, in Western Australia. The site was listed under the Ramsar Convention in 1990.	The lakes are surrounded by medium density urban development and some agricultural land. The sediments of Thomsons Lake are between 30,000 and 40,000 years old, which are the oldest lake sediments discovered in WA to date. These lakes are the best remaining examples of brackish, seasonal lakes with extensive fringing sedgeland, typical of the Swan Coastal Plain. The site meets criteria 1, 3, 5 and 6 of the Ramsar Convention.
Peel-Yalgorup System	Ramsar	Peel-Yalgorup System, located adjacent to the City of Mandurah in	Peel-Yalgorup System Ramsar site is the most important area for waterbirds in south-western Australia. It supports a large number of waterbirds, and a

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Protected Area	IUCN Protected Area Category* or Relevant Park Zone	Description	Conservation Values
		WA, is a large and diverse system of shallow estuaries, coastal saline lakes and freshwater marshes. The site was listed under the Ramsar Convention in 1990.	wide variety of waterbird species. It also supports a wide variety of invertebrates, and estuarine and marine fish. The site meets criteria 1, 3, 5 and 6 of the Ramsar Convention.
Vasse-wonnerup system	Ramsar	Vasse-Wonnerup System Ramsar wetland is situated in the Perth Basin, south-western WA. The site was listed under the Ramsar Convention in 1990.	Vasse-Wonnerup System is an extensive, shallow, nutrient-enriched wetland system of highly varied salinities. Large areas of the wetland dry out in late summer. Vasse-Wonnerup System supports tens of thousands of resident and migrant waterbirds of a wide variety of species. More than 80 species of waterbird have been recorded in the System such as red-necked avocets and black-winged stilts, wood sandpiper, sharp-tailed sandpiper, long-toed stint, curlew sandpiper and common greenshank. Thirteen waterbird species are also known to breed at the Ramsar site, including the largest regular breeding colony of black swans in south-western Australia. The site meets criteria 5 and 6 of the Ramsar Convention.
Wetlands of National Importance (DAWE, 2019)			
Rottnest Island Lakes		The Rottnest Island Lakes site is the cluster of 18 lakes and swamps on the north-east part of Rottnest Island.	An outstanding example of a series of lakes/swamps of varied depth and salinity located on an offshore island; the only island among 200 plus in WA exceeding 10 ha in area, that has a salt-lake complex; the only known example of seasonally meromictic lakes in Australia. The area meets criteria 1, 2, 3 and 6 for inclusion on the Directory of Important Wetlands in Australia.
Australian Marine Parks (DNP, 2018b)			
Abrolhos Marine Park	II, IV, VI	The Abrolhos Marine Park is located within both the NWMR and SWMR. Refer **Table 10-1** for description and conservation values.	
Bremer Marine Park	II, VI	Bremer Marine Park covers an area of 4472 km^2 and is located approximately half-way between Albany and Esperance, offshore from the Fitzgerald River National Park, extending from the WA State waters boundary.	Bremer Marine Park is significant because it contains habitats, species and ecological communities associated with two bioregions: • Southern Province • South-west Shelf Province. It includes two KEFs: Albany Canyon group and adjacent shelf break; and Ancient coastline at 90-120 m depth.

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Protected Area	**IUCN Protected Area Category* or Relevant Park Zone**	**Description**	**Conservation Values**
			The AMP supports a range of species including species listed as threatened, migratory, marine or cetacean under the EPBC Act. BIAs within the AMP include foraging habitat for seabirds, Australian sea lions, and white sharks, a migratory pathway for humpback whales, and a significant calving area for southern right whales. The AMP includes canyons—important aggregation areas for killer whales.
Eastern Recherche Marine Park	II, VI	Eastern Recherche Marine Park covers an area of 20,575 km^2 and is located ~135 km east of Esperance, adjacent to the Recherche Archipelago, close to the WA Cape Arid National Park.	Eastern Recherche Marine Park is significant because it contains habitats, species and ecological communities associated with three bioregions: • South-west Shelf Province • Southern Province • Great Australian Bight Shelf Transition. It includes three KEFs: Mesoscale eddies; Ancient coastline at 90-120 m depth; and Commonwealth marine environment surrounding the Recherche Archipelago. The AMP supports a range of species including species listed as threatened, migratory, marine or cetacean under the EPBC Act. BIAs within the AMP include foraging habitat for seabirds, Australian sea lions and white sharks, and a calving buffer area for southern right whales.
Geographe Marine Park	II, IV, VI	Geographe Marine Park covers an area of 977 km^2 and is located in Geographe Bay, ~8 km west of Bunbury and 8 km north of Busselton, adjacent to the WA Ngari Capes Marine Park.	Geographe Marine Park is significant because it contains habitats, species and ecological communities associated with the South-west Shelf Province bioregion. It includes two KEFs: Commonwealth marine environment within and adjacent to Geographe Bay; and Western rock lobster. The AMP supports a range of species including species listed as threatened, migratory, marine or cetacean under the EPBC Act. BIAs within the AMP include foraging habitat for seabirds, a migratory pathway for humpback and pygmy blue whales, and a calving buffer area for southern right whales.
Great Australian Bight Marine Park	II, VI	Great Australian Bight Marine Park covers an area of 45,822 km^2 and is located ~12 km south-east of Eucla and 174 km west of Ceduna, adjacent to the SA Far West Coast and Nuyts Archipelago Marine Parks.	Great Australian Bight Marine Park is significant because it contains habitats, species and ecological communities associated with two bioregions: • Great Australian Bight Shelf Transition • Southern Province. It includes three KEFs: Ancient coastline at 90-120 m depth; Benthic invertebrate communities of the eastern Great Australian Bight; and Small pelagic fish of the South-west Marine Region. The AMP supports a range of species including species listed as threatened, migratory, marine or cetacean under the EPBC Act. BIAs within the AMP include foraging habitat for seabirds, Australian sea lions, white sharks and

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Protected Area	IUCN Protected Area Category* or Relevant Park Zone	Description	Conservation Values
			pygmy blue and sperm whales, and a calving area, migratory pathway and large aggregation area for southern right whales.
Jurien Marine Park	II, VI	Jurien Marine Park covers an area of 1851 km^2 and is located ~148 km north of Perth and 155 km south of Geraldton, adjacent to the WA Jurien Bay Marine Park.	Jurien Marine Park is significant because it includes habitats, species and ecological communities associated with two bioregions: • South-west Shelf Transition • Central Western Province. It includes three KEFs: Ancient coastline at 90-120 m depth; Demersal slope and associated fish communities of the Central Western Province; and Western rock lobster The AMP supports a range of species including species listed as threatened, migratory, marine or cetacean under the EPBC Act. BIAs within the AMP include foraging habitat for seabirds, Australian sea lions and white sharks, and a migratory pathway for humpback and pygmy blue whales.
Perth Canyon Marine Park	II, IV, VI	Perth Canyon Marine Park covers an area of 7409 km^2 and is located ~52 km west of Perth and ~19 km west of Rottnest Island.	Perth Canyon Marine Park is significant because it includes habitats, species and ecological communities associated with four bioregions: • Central Western Province • South-west Shelf Province • Southwest Transition • South-west Shelf Transition. It includes four KEFs: Perth Canyon and adjacent shelf break, and other west-coast canyons; Demersal slope and associated fish communities of the Central Western Province; Western rock lobster; and Mesoscale eddies. The AMP supports a range of species including species listed as threatened, migratory, marine or cetacean under the EPBC Act. BIAs within the AMP include foraging habitat for seabirds, Antarctic blue, pygmy blue and sperm whales, a migratory pathway for humpback, Antarctic blue and pygmy blue whales, and a calving buffer area for southern right whales.
South-west Corner Marine Park	II, IV, VI	South-west Corner Marine Park covers an area of 271,833 km^2 and is located adjacent to the WA Ngari Capes Marine Park. It covers an extensive offshore area that is closest to WA State waters ~48 km west of Esperance, 73 km west of Albany and 68 km west of Bunbury.	South-west Corner Marine Park is significant because it contains habitats, species and ecological communities associated with three bioregions: • Southern Province • South-west Transition • South-west Shelf Province. It includes six KEFs: Albany Canyon group and adjacent shelf break; Cape Mentelle upwelling; Diamantina Fracture Zone; Naturaliste Plateau; Western rock lobster; and Ancient coastline at 90 m-120 m depth.

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Protected Area	IUCN Protected Area Category* or Relevant Park Zone	Description	Conservation Values
			The AMP supports a range of species including species listed as threatened, migratory, marine or cetacean under the EPBC Act. BIAs within the AMP include foraging habitat for seabirds, Australian sea lions, white sharks and sperm whales, a migratory pathway for Antarctic blue, pygmy blue and humpback whales, and a calving buffer area for southern right whales.
Twilight Marine Park	II, VI	Twilight Marine Park covers an area of 4641 km^2 and is located ~245 km south-west of Eucla and 373 km north-east of Esperance, adjacent to the WA State waters boundary.	Twilight Marine Park is significant because it contains habitats, species and ecological communities associated with the Great Australian Bight Shelf Transition bioregion. The AMP supports a range of species including species listed as threatened, migratory, marine or cetacean under the EPBC Act. BIAs within the AMP include foraging habitat for seabirds, Australian sea lions and white sharks, and a calving buffer area for southern right whales.
Two Rocks Marine Park	II, VI	Two Rocks Marine Park covers an area of 882 km^2 and is located ~25 km north-west of Perth, to the north-west of the WA Marmion Marine Park.	Two Rocks Marine Park is significant because it includes habitats, species and ecological communities associated with the South-west Shelf Transition bioregion. It includes three KEFs: Commonwealth marine environment within and adjacent to the west-coast inshore lagoons; Western rock lobster; and Ancient coastline at 90-120 m depth. The AMP supports a range of species including species listed as threatened, migratory, marine or cetacean under the EPBC Act. BIAs within the AMP include foraging habitat for seabirds and Australian sea lions, a migratory pathway for humpback and pygmy blue whales, and a calving buffer area for southern right whales.
State Marine Parks and Reserves			
Jurien Bay Marine Park	Sanctuary, Special Purpose and General Use Zones.	The Jurien Bay Marine Park is located on the central west coast of WA ~200 km north of Perth and covers an area of 824 km^2.	An extensive limestone reef system parallel to the shore has created a huge shallow lagoon that provides perfect habitat for Australian sea lions, dolphins and a myriad of juvenile fish. Extensive seagrass meadows inside the reef shelter many marine animals such as western rock lobsters, octopus and cuttlefish that make up the diet of young sea lions. The marine park also surrounds dozens of ecologically important islands that contain rare and endangered animals found nowhere else in the world (CALM, 2005b).
Marmion Marine Park	Sanctuary, Recreation and Special Use Zones.	The Marmion Marine Park lies within State waters between Trigg Island and Burns Beach and encompasses a coastal area of ~95 km^2. Marmion	The marine park has a number of sanctuary zones including Little Island, The Lumps and the Boyinaboat Reef protecting a variety of habitats from limestone reefs, seagrass beds and clear shallow lagoons that support a diversity of marine life. In addition, to a general use zone and the Waterman Recreation Area. The marine park contains important habitat for the endemic Australian

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Protected Area	IUCN Protected Area Category* or Relevant Park Zone	Description	Conservation Values
		Marine Park was the State's first marine park, declared in 1987.	sea lion, an array of seabird species migratory whales are regular visitors (CALM, 1992; DPAW, 2016d).
Swan Estuary Marine Park	Special Purpose and Nature Reserve Zones.	Three biologically important areas of Perth's Swan River make up the Swan Estuary Marine Park, including Alfred Cove, Pelican Point and Crawley. These three sites cover a total area of 3.4 km^2.	The sand flats, mud flats and beaches at the three locations of the Swan Estuary Marine Park provide the only remaining significant feeding and resting areas in the Swan Estuary, for trans-equatorial migratory wading and waterbirds. The Park and adjacent reserves also provide habitat for a diverse assemblage of aquatic and terrestrial flora and fauna (CALM, 1999).
Shoalwater Islands Marine Park	Sanctuary, Special Purpose and General Use Zones.	The Shoalwater Islands Maine Park is located adjacent to Rockingham on the south-west coast of WA, ~50 km south of Perth and covers an area of ~66 km^2.	The Shoalwater Islands Marine Park consists of a complex seabed and coastal topography consisting of islands, limestone ridges and reef platforms, protected inshore areas and deeper basins, sandbars and beaches, and is home to five species of cetacean and 14 species of sea and shore bird. The waters of the marine park are also used to access feeding grounds for the little penguin (*Eudyptula minor*) colony on Penguin Island, which is close to the northernmost limit of the species' range and is the largest known breeding colony in Western Australia (DEC, 2007c).
Ngari Capes Marine Park	Sanctuary, Special Purpose and Recreation Zones.	The Ngari Capes Marine Park is located off the south-west coast of WA, ~250 km south of Perth, covering ~1238 km^2.	The Ngari Capes Marine Park consists of a complex arrangement of sandy bays, high energy limestone and granite reefs bordered by headlands and cliffs and two weathered capes. Coral communities consist of both tropical and temperate species. Cetaceans and pinnipeds are resident in and/or transient through the marine park as well as a diverse range of seabirds and shorebirds (DEC, 2013).
Walpole and Nornalup Inlets Marine Park	Recreation Zone.	The Walpole and Nornalup Inlets Marine Park is located adjacent to the towns of Walpole and Nornalup on the south coast of WA, ~120 km west of Albany, and covers ~14 km^2.	The Walpole and Nornalup Inlets Marine Park consists of a geologically complex lagoonal estuarine system comprising three significant rivers and two connected inlets that are permanently open to the ocean. Approximately 40 marine and estuarine finfish species commonly inhabit the inlet system, as well as a variety of shark and ray species and numerous seabirds and shorebirds. The sandy beaches and shoreline vegetation of the inlet system are of high ecological and social importance to the marine park (DEC, 2009).

**Conservation objectives for IUCN categories include:*

Ia: Strict Nature Reserve

Ib: Wilderness Area

II: national Park

III: Natural Monument or Feature

IV: Habitat/Species Management Area

V: Protected Landscape

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VI: Protected area with sustainable use of natural resources – allow human use but prohibits large scale development.

IUCN categories for the marine park are provided and, in brackets, the IUCN categories for specific zones within each Marine Park as assigned under the South-west Marine Parks Network Management Plan 2018 (DNP, 2018b)

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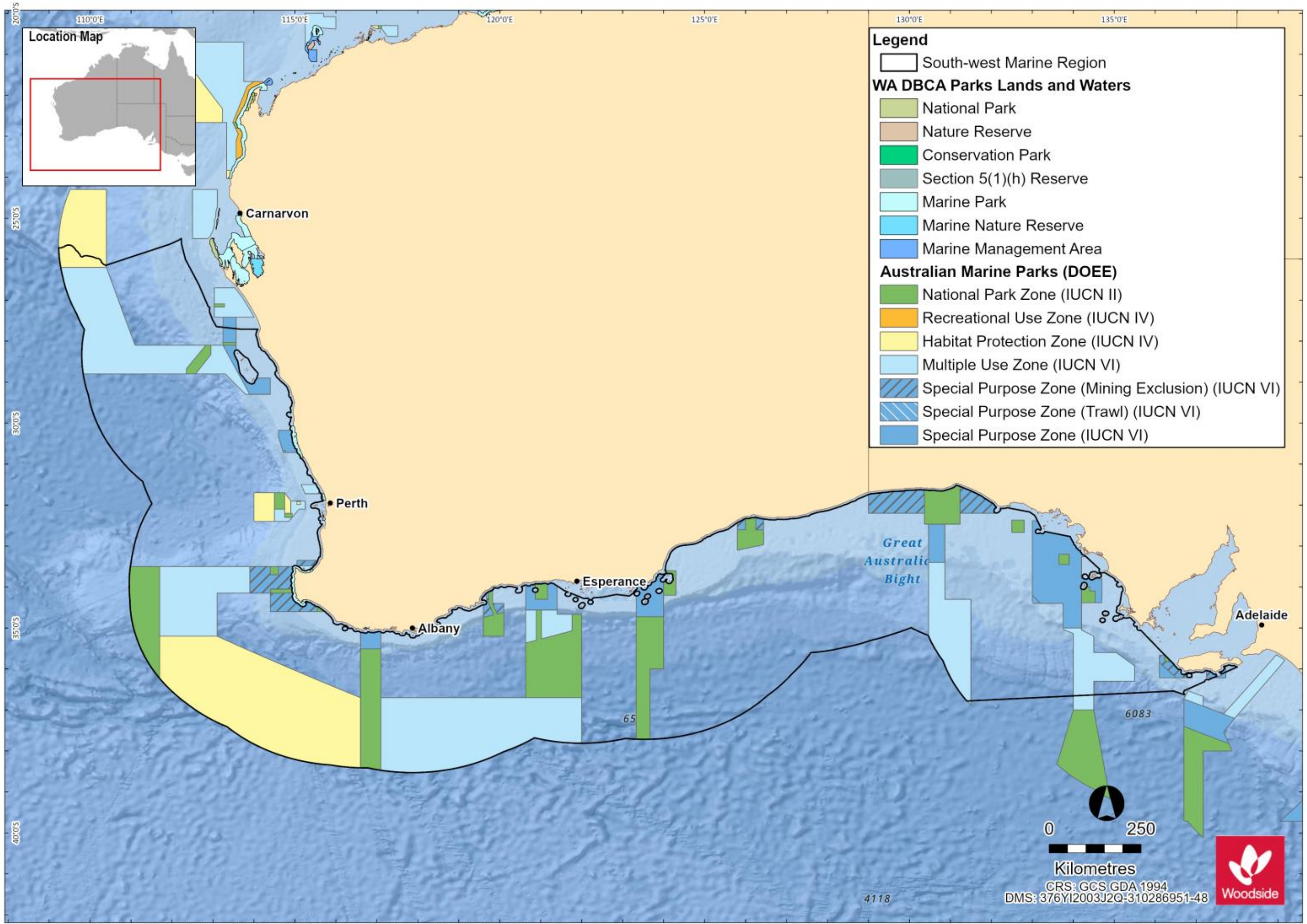

Basemap Sources: Esri, HERE, Garmin, GEBCO, National Geographic, NOAA, and the GIS User Community, Esri, Garmin, GEBCO, NOAA NGDC, and other contributors

Figure 10-2. Commonwealth and State Marine Protected Areas for the SWMR

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10.11 Summary of Protected Areas within the NMR

Table 10-3 Protected Areas within the NMR

Protected Area	IUCN Protected Area Category* or Relevant Park Zone	Description	Conservation Values
World Heritage Properties			
Kakadu National Park		Kakadu National Park is a living landscape with exceptional natural and cultural values. It is the largest National Park in Australia and preserves the greatest variety of ecosystems on the Australian continent including extensive areas of floodplains, mangroves, tidal mudflats, coastal areas and monsoon forests. The park was inscribed the World Heritage list in three stages over 11 years. It is located in tropical north Australia covering a total area of 19,804 square kilometres.	The conservation values reflect the WHA Criterion: (i), (vi), (vii) and (ix): Natural features relate to Criterion (vii) – the remarkable contrast between the internationally recognised Ramsar-listed wetlands and the spectacular rocky escarpment and its outliers and Criterion (ix) – four major river systems of tropical Australia and floodplains that are dynamic environments, shaped by changing sea levels and big floods every wet season. These floodplains illustrate the ecological and geomorphological effects that have accompanied Holocene climate change and sea level rise. Kakadu National Park contains important and significant habitats supporting a diverse range of flora and fauna.
National Heritage Places - Natural			
Kakadu National Park		Refer to World Heritage property description above.	Refer to World Heritage property conservation values above
Commonwealth Heritage Places - Natural			
N/A			
Wetlands of International Importance (Ramsar)			
Kakadu National Park		Australian Ramsar site number 2. The stage 1 and 2 Ramsar sites, established in 1980, 1985 and 1989, respectfully were combined into a single Ramsar site in 2010.	The Kakadu National Park Ramsar site straddles the western edge of the Arnhem Land Plateau encompassing a range of landforms and extensive floodplains. It is a mosaic of contiguous wetlands comprising the catchments of two large river systems, the East and South Alligator rivers and encompasses extensive tidal mudflat areas. It is an internationally important site for migratory shorebirds as part of the EAAF.

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Protected Area	IUCN Protected Area Category* or Relevant Park Zone	Description	Conservation Values
Cobourg Peninsula		Australian Ramsar site number 1 established in 1974. This Ramsar site includes freshwater and extensive intertidal areas but excludes subtidal areas. It is in a remote location and there has been minimal human impact on the site.	The wetlands encompassed in the Ramsar site are some of the better protected and near-natural wetlands in the bioregion and there is a diverse array of wetland in a confined area. The site supports important turtle nesting habitat and habitat for coastal dolphin species and is an internationally significant migratory shorebird habitat as part of the EAAF and an important location for seabird breeding colonies.
Wetlands of National Importance (DAWE, 2019)			
Southern Gulf Aggregation		The site is a complex continuous wetland aggregation in the Gulf of Carpentaria, covering an area of ~5460 km^2 located 58 km east of Burketown, Queensland.	The Southern Gulf Aggregation is the largest continuous estuarine wetland aggregation of its type in northern Australia. It is one of the three most important areas for shorebirds in Australia. The area meets criteria 1, 2, 3, 4, 5 and 6 for inclusion on the Directory of Important Wetlands in Australia.
Australian Marine Parks (DNP, 2018c)			
Arafura Marine Park	VI	Arafura Marine Park covers an area of 22,924 km^2 is located ~256 km north-east of Darwin and 8 km offshore of Croker Island, NT. It extends from NT waters to the limit of Australia's EEZ.	The AMP is significant because it contains habitats, species and ecological communities associated with two bioregions: • Northern Shelf Province • Timor Transition. It includes one KEF: Tributary canyons of the Arafura Depression. The AMP supports a range of species, including species listed as threatened, migratory, marine or cetacean under the EPBC Act. BIAs within the AMP include internesting habitat for marine turtles and important foraging and breeding habitat for seabirds.
Arnhem Marine Park	VI	Arnhem Marine Park covers an area of 7125 km^2 and is located ~100 km south-east of Croker Island and 60 km south-east of the Arafura Marine Park. It extends from NT waters surrounding the Goulburn Islands, to the waters north of Maningrida.	Arnhem Marine Park is significant because it contains habitats, species and ecological communities associated with the Northern Shelf Province bioregion. The AMP supports a range of species, including species listed as threatened, migratory, marine or cetacean under the EPBC Act. BIAs within the AMP include foraging habitat and a migratory pathway for marine turtles and seabirds.
Gulf of Carpentaria Marine Park	II, VI	Gulf of Carpentaria Marine Park covers an area of 23,771 km^2 and is located ~90 km north-west of Karumba, Queensland and is adjacent to the Wellesley Islands in	Gulf of Carpentaria Marine Park is significant because it contains habitats, species and ecological communities associated with the Northern Shelf Province bioregion.

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Protected Area	IUCN Protected Area Category* or Relevant Park Zone	Description	Conservation Values
		the south of the Gulf of Carpentaria basin.	It includes four KEFs: Gulf of Carpentaria basin; Gulf of Carpentaria coastal zone; Plateaux and saddle north-west of the Wellesley Islands; and Submerged coral reefs of the Gulf of Carpentaria. The AMP supports a range of species, including species listed as threatened, migratory, marine or cetacean under the EPBC Act. BIAs within the AMP include breeding and foraging areas for seabirds and internesting and foraging areas for turtles.
Joseph Bonaparte Gulf Marine Park	VI	The Joseph Bonaparte Gulf Marine Park is located within both the NWMR and NMR. Refer **Table 10-1** for description and conservation values.	
Limmen Marine Park	IV	Limmen Marine Park covers an area of 1399 km^2 and is located ~315 km south-west of Nhulunbuy, NT, in the south-west of the Gulf of Carpentaria. It extends from NT waters, between the Sir Edward Pellew Group of Islands and Maria Island in the Limmen Bight, adjacent to the NT Limmen Bight Marine Park.	Limmen Marine Park is significant because it contains habitats, species and ecological communities associated with the Northern Shelf bioregion. It includes one KEF: Gulf of Carpentaria coastal zone. The AMP supports a range of species, including species listed as threatened, migratory, marine or cetacean under the EPBC Act. BIAs within the AMP include internesting and foraging habitat for marine turtles.
Oceanic Shoals Marine Park	II, IV, VI	The Oceanic Shoals Marine Park is located within both the NWMR and NMR. Refer **Table 10-1** for description and conservation values.	
Wessel Marine Park	IV, VI	Wessel Marine Park covers an area of 5908 km^2 and is located ~22 km east of Nhulunbuy, NT. It extends from NT waters adjacent to the tip of the Wessel Islands to NT waters adjacent to Cape Arnhem.	Wessel Marine Park is significant because it contains habitats, species and ecological communities associated with the Northern Shelf bioregion. It includes one KEF: Gulf of Carpentaria basin. The AMP supports a range of species, including species listed as threatened, migratory, marine or cetacean under the EPBC Act. BIAs within the AMP include breeding habitat for seabirds and internesting and foraging habitat for marine turtles.
West Cape York Marine Park	II, IV, VI	West Cape York Marine Park covers an area of 16,012 km^2 and is located adjacent to the northern end	West Cape York Marine Park is significant because it contains species and ecological communities associated with two bioregions: • Northeast Shelf Transition

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Protected Area	IUCN Protected Area Category* or Relevant Park Zone	Description	Conservation Values
		of Cape York Peninsula ~25 km south-west of Thursday Island and 40 km north-west of Weipa, Queensland.	• Northern Shelf Province. It includes two KEFs: Gulf of Carpentaria basin; and Gulf of Carpentaria coastal zone. The AMP supports a range of species, including species listed as threatened, migratory, marine or cetacean under the EPBC Act. BIAs within the AMP include breeding and foraging habitat for seabirds, internesting and foraging habitat for marine turtles and dugong, and foraging, breeding and calving habitat for dolphins.
Territory Marine Parks and Reserves			
Cobourg Marine Park	II, IV, VI	Cobourg Marine Park covers an area of 2,290 km^2 and is located in the waters surrounding the Cobourg Peninsula ~220 km north-east of Darwin. The Marine Park is part of the larger Garig Gunak Barlu National Park. Garig Gunak Barlu National Park includes both the Marine Park and the Cobourg Sanctuary.	Cobourg Marine Park is located in the Cobourg and Van Diemen Gulf marine bioregions with the northern portion of the Park covered by the Cobourg marine bioregion and the southern portion covered by the Van Diemen Gulf marine bioregion. The Marine Park is characterised by a number of deeply incised bays and estuaries on its northern shores. These bays are ancient river valleys that were drowned during periods of sea level rise and provide a varied environment and habitat that is quite distinct from the open water areas of the Park. The areas of the Park that have been studied and where extensive collections have been made indicates that the Park supports rich and diverse marine life including live coral reefs, seagrass, diverse reef and pelagic fish populations, marine turtles and dugong.

**Conservation objectives for IUCN categories include:*

Ia: Strict Nature Reserve

Ib: Wilderness Area

II: National Park

III: Natural Monument or Feature

IV: Habitat/Species Management Area

V: Protected Landscape

VI: Protected area with sustainable use of natural resources – allow human use but prohibits large scale development.

IUCN categories for the marine park are provided and, in brackets, the IUCN categories for specific zones within each Marine Park as assigned under the North Marine Parks Network Management Plan 2018 (DNP, 2018c)

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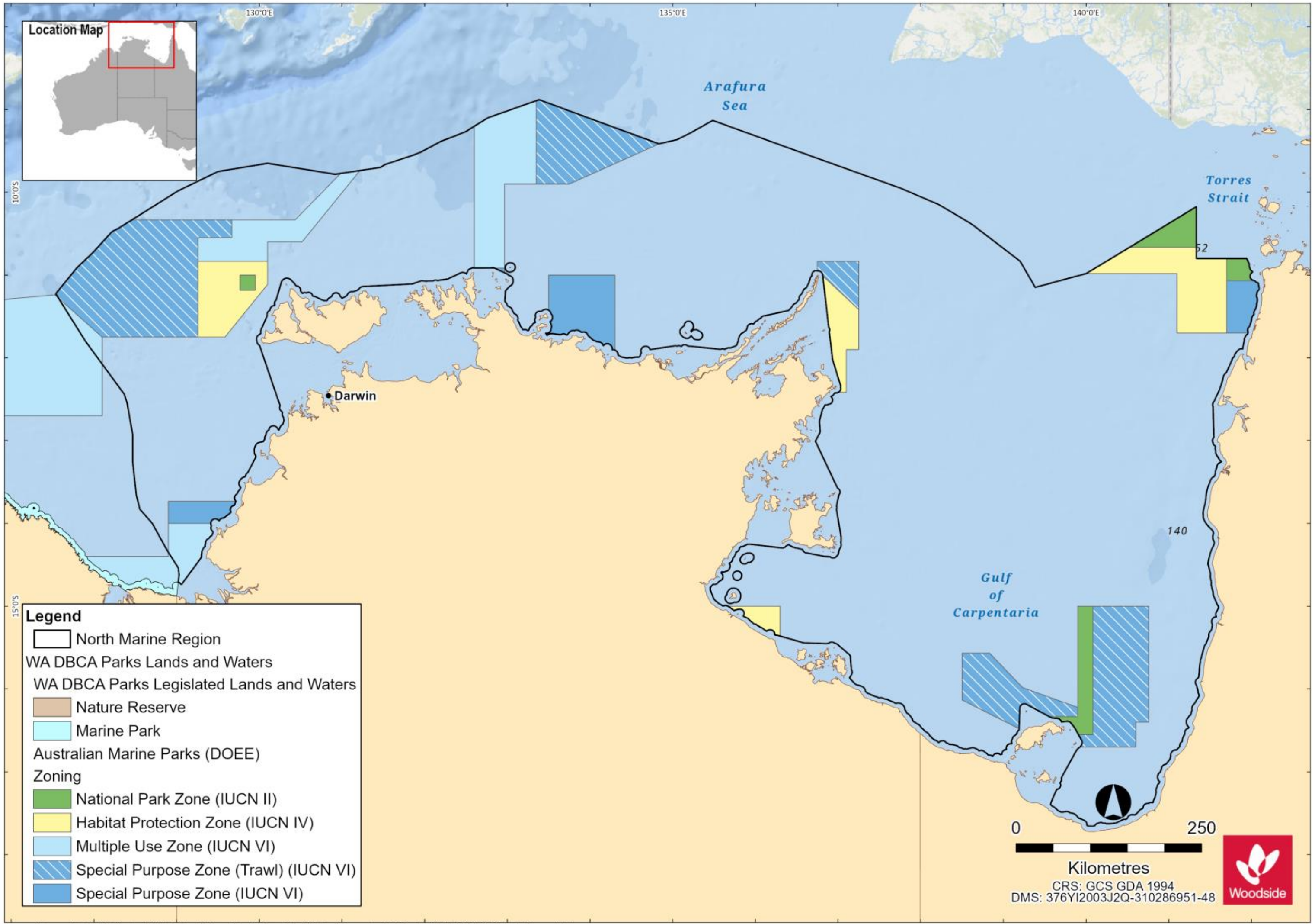

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Figure 10-3. Commonwealth and State Marine Protected Areas within the NMR

11. SOCIO-ECONOMIC AND CULTURAL ENVIRONMENT

This section summarises the information relating to the socio-economic and cultural environment of the regions offshore Western Australia, with a focus on the NWMR and to a lesser extent the SWMR and NWR.

The cultural environment includes Indigenous and European heritage values, including underwater values such as historic shipwrecks. Socio-economic values include commercial and traditional fishing, tourism and recreation, shipping, oil and gas activities and defence activities.

11.1 Cultural Heritage

11.1.1 Indigenous Sites of Significance

Murujuga (the Burrup Peninsula) has a very high density of significant Indigenous heritage sites and places with tangible and intangible heritage values. The area has one of the largest, densest, and most diverse collections of rock art in the world. It is estimated that the peninsula and surrounding islands contain over a million petroglyphs (rock engravings) covering a broad range of styles and subjects. The landscape also contains quarries, middens, fish traps, rock shelters, ceremonial sites, artefact scatters, grinding patches and stone arrangements that evidence tens of thousands of years of human occupation. These places are linked to Aboriginal cosmology, Dreaming stories and songs through the stories, knowledge and customs that are still held by traditional custodians.

In 2007 the Dampier Archipelago (including the Burrup Peninsula) was included on the National Heritage List due to outstanding heritage values relating to Australia’s cultural history contained in the large number, density, diversity, distribution and fine execution of rock art. Within the National Heritage Place, the Murujuga National Park covers 4913 ha and is co-managed by the Murujuga Aboriginal Corporation and the Department of Biodiversity, Conservation and Attractions. The Murujuga Cultural Landscape was also added to Australia’s Tentative World Heritage List in 2020, with full World Heritage Listing anticipated in 2024.

Woodside also recognises the potential for heritage to survive in submerged landscapes. Sea-level rises since the last ice age mean that areas now under the sea were once exposed, that many of today’s islands would have been connected to the mainland, and that Aboriginal people are highly likely to have inhabited these places. Woodside works with traditional custodians, academics and heritage professionals to identify tangible and intangible heritage values in the submerged landscape to avoid disturbing heritage where possible and to minimise impacts where heritage cannot be avoided.

It is an offence to excavate, destroy, damage, conceal or alter Indigenous heritage onshore or in state waters under section 17 of the *Aboriginal Heritage Act 1972 (WA) (AHA)* without ministerial authorisation. Where there is a risk of injury or desecration to a significant Aboriginal area, even where permitted under the AHA, any Aboriginal person may apply to the federal Environment Minister for a declaration under sections 9 or 10 of the *Aboriginal and Torres Strait Islander Heritage Protection Act 1984 (Cth)* for the protection and preservation of that area.

The Department of Planning, Lands and Heritage maintains a register of registered sites and heritage places including middens, burial, ceremonial [sites], artefacts, rock shelters, mythological [sites] and engraving sites. There are over 1600 registered sites on Murujuga and the Dampier Archipelago with around 1100 other heritage places. This register is not comprehensive and will be complemented by heritage surveys where necessary. Protection of National and World Heritage values is also legislated through various provisions of the *Environment Protection and Biodiversity Conservation Act 1999 (Cth)*. Murujuga National Park is managed under the *Conservation and Land Management Act 1984 (WA)*.

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11.1.2 European Sites of Significance

European sites of significance and heritage value are found along adjacent foreshores of the SWMR, NWMR and NWR. Heritage values are protected in Western Australia under the *Heritage Act 2018*.

11.1.3 Underwater Cultural Heritage

Places of historic cultural significance are protected under Commonwealth, State and local regimes. Places inscribed on the National or World Heritage list are protected through various provisions of the *Environment Protection and Biodiversity Conservation Act 1999* (Cth). Historic places may also be protected under the *Heritage Act 2018* (WA); under section 129 the prohibited alteration, demolition, damage, despoilment or removal of objects from a registered place may result in a fine of A$1 million. Protection of heritage by local government typically emanates from local planning schemes produced under Part 5 of the *Planning and Development Act 2005* (WA).

The remains of vessels and aircraft in Commonwealth waters, along with any associated article, are automatically protected under the *Underwater Cultural Heritage Act 2018* (Cth) after 75 years. Remains and relics of any ship lost, wrecked or abandoned in Western Australian waters before 1900 are protected by the *Maritime Archaeology Act 1973* (WA).

The Australian National Shipwreck Database and the WA Maritime Museum Shipwreck Database list these protected wrecks.

11.1.4 National and Commonwealth Listed Heritage Places

Australia's National Heritage Sites are those of outstanding natural, historic and/or Indigenous significance to Australia. National Heritage places classed as natural are discussed in **Section 10.3**. Historic and/or Indigenous National Heritage Listed Places of the NWMR include:

- Dampier Archipelago (including Burrup Peninsula)
- Dirk Hartog Landing Site/Cape Inscription
- HMAS Sydney II and the HSK Kormoran Shipwreck Sites
- Batavia Shipwreck Site and Survivor Camps Area 1629 – Houtman Abrolhos

Commonwealth Heritage Places are a collection of sites recognised for their Indigenous, historical and/or natural values, which are owned or controlled by the Australian Government. A number of these sites are owned or controlled by the Department of Defence, as well as Government agencies relating to maritime safety, customs and communication. Commonwealth Heritage places classed as natural are discussed in **Section 10.3**. Listed Heritage Places in the NWMR include:

- Mermaid Reef – Rowley Shoals (refer **Section 10.3**)
- Ashmore Reef National Nature Reserve (refer **Section 10.3**)
- Scott Reef and Surrounds – Commonwealth Area (refer **Section 10.3**)
- Ningaloo Marine Area (refer **Section 10.3**)

World Heritage Properties are those sites that hold universal value which transcends any value they may be held by any one nation. These sites and their qualities are detailed in the Convention concerning the Protection of the World Cultural and Natural Heritage (the World Heritage Convention), to which Australia is a founding member. The Protected Matters Search Report (**Appendix A**) lists two natural World Heritage Properties in the NWMR (refer **Section 10.2**). There are no cultural heritage listings located within the NWMR.

Summary tables of heritage places for NWMR, SWMR and NMR are presented in **Table 11-1,Table 11-2** and **Table 11-3**.

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11.2 Summary of Heritage Places within the NWMR

Table 11-1 Heritage Places (Indigenous and Historic) within the NWMR

Heritage Places	Woodside Activity Area			Class	Description	Conservation Values
	Browse	NWS/S	NW Cape			
National Heritage Properties						
Dampier Archipelago (including Burrup Peninsula)	-	✓	-	Indigenous	The Dampier Archipelago (including the Burrup Peninsula) contains one of the densest concentrations of rock engravings in Australia with some sites containing thousands or tens of thousands of images.	The rock engravings comprise images of avian, marine and terrestrial fauna, schematised human figures, figures with mixed human and animal characteristics and geometric designs. At a national level it has an exceptionally diverse and dynamic range of schematised human figures some of which are arranged in complex scenes. The fine execution and dynamic nature of the engravings, particularly some of the composite panels, exhibit a degree of creativity that is unusual in Australian rock engravings.
Dirk Hartog Landing Site 1616 – Cape Inscription Area	-	-	✓	Historic	Cape Inscription is the site of the oldest known landings of Europeans on the WA coastline.	The Cape Inscription area displays uncommon aspects of Australia's cultural history because of the cumulative effect its association with these explorers and surveyors had on growing knowledge of the great southern continent in Europe. The association of the site with these early navigators stimulated the development of the European view of the great southern continent at a time when they began to look at the world with a modern scientific outlook.
Commonwealth Heritage Properties						
N/A						

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11.3 Summary of Heritage Places within the NMR

Table 11-2 Heritage Places (Indigenous and Historic) within the NMR

Heritage Places	Class	Description	Conservation Values
National Heritage Properties			
None			
Commonwealth Heritage Properties			
None			

11.4 Summary of Heritage Places within the SWMR

Table 11-3 Heritage Places (Indigenous and Historic) within the SWMR

Heritage Places	Class	Description	Conservation Values
National Heritage Properties			
Cheetup Rock Shelter	Indigenous	Cheetup meaning “place of the birds” is the name of a spacious rock shelter located in Cape Le Grand National Park, about 55 km east of Esperance in WA. Aboriginal people associated with the place identify themselves as Nyungar/Noongar, Ngadju (shortened from Ngadjunmaia) or Mirning.	Cheetup rock shelter provides outstanding evidence for the antiquity of processing and use of cycad seeds by Aboriginal people. The seeds of the cycad are extremely toxic and can cause speedy death if eaten fresh without proper preparation to remove the toxins. The presence of *Macrozamia riedlei* seeds in a pit lined with Xanthorrhoea (grass tree) leaf bases indicates that the Aboriginal people in the Esperance region had the knowledge to remove the toxins of this important source of carbohydrate and protein at least 13,200 years ago.

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Heritage Places	Class	Description	Conservation Values
Batavia Shipwreck Site and Survivor Camps Area 1629 – Houtman Abrolhos	Historic	The Batavia and its associated sites hold an important place in the discovery and delineation of the WA coastline. The wreck of the Batavia, and other Dutch ships like her, convinced the VOC (Dutch East India Company) of the necessity of more accurate charts of the coastline and resulted in the commissioning of Vlamingh's 1696 voyage.	Because of its relatively undisturbed nature the archaeological investigation of the wreck itself has revealed a range of objects of considerable value as well as to artefact specialists and historians.
HMAS Sydney II and HSK Kormoran Shipwreck Sites	Historic	The naval battle fought between the Australian warship HMAS Sydney II and the German commerce raider HSK Kormoran off the WA coast during World War II was a defining event in Australia's cultural history. HMAS Sydney II was Australia's most famous warship of the time and this battle has forever linked the stories of these warships to each other. The loss of HMAS Sydney II along with its entire crew of 645 following the battle with HSK Kormoran, remains as Australia's worst naval disaster.	The shipwreck sites of HMAS Sydney II and HSK Kormoran have outstanding heritage value to the nation because of their importance in a defining event in Australia's cultural history and for their part in development of the process of the defence of Australia.
Commonwealth Heritage Properties			
Cliff Point Historic Sites	Historic	Cliff Head is a limestone bluff on the east coast of Garden Island. Evidence of occupation has been reported from the beach just north of the head, the immediate hinterland, the ridge above and on the south face of the ridge.	The Cliff Point Historic Site, individually significant within the area of Garden Island is important as the first site inhabited by Governor Stirling's party in 1829 when founding the colony of WA, and as WA's first official non-convict settlement. The site was occupied in the first instance by Captain Charles Fremantle before the arrival of Captain Stirling. The party occupied the site for two months before a move was made to the Swan River settlement on the mainland.
HMAS Sydney II and HSK Kormoran Shipwreck Sites	Historic	As above	As above
J Gun Battery	Historic	J Battery comprised two 155 mm long range guns, the other similar battery being at Cape Peron on the mainland at the entrance to Cockburn Sound. Located in the dune systems at the north western	J Gun Battery (1942) is individually significant within the area of Garden Island (Register No. 019544) and is historically important as the first gun battery constructed on Garden Island and as one of two long range gun batteries which played a

Heritage Places	Class	Description	Conservation Values
		corner of Garden Island elements of the J Battery complex are now covered in part by sand.	strategic role in the coastal defences of Cockburn Sound and Fremantle following the entry of Japan into the Second World War (1939-45).

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11.5 Fisheries - Commercial

11.5.1 Commonwealth and State Fisheries

The diverse range of habitats and species offshore WA has allowed for various fisheries to develop and operate throughout the region.

The Australian Fisheries Management Authority (AFMA) manages fisheries on behalf of the Commonwealth Government and is bound by objectives under the Commonwealth *Fisheries Management Act 1991*.

WA State commercial fisheries are managed by the WA Department of Primary Industries and Regional Development (WA DPIRD) under the WA *Fish Resources Management Act 1994* (FRMA), Fisheries Resources Management Regulations 1995, relevant gazetted notices and licence conditions, and applicable Fishery Management Plans.

Commonwealth and State managed fisheries that operate within the NWMR and in areas beyond this region are summarised in the **Table 11-4**.

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Table 11-4 Commonwealth and State managed fisheries

<table>
<tr><th rowspan="2">Fishery</th><th colspan="3">Woodside Activity Area</th><th rowspan="2" colspan="3">Description</th></tr>
<tr><th>Browse</th><th>NWS/S</th><th>NW Cape</th></tr>
<tr><td colspan="7">Commonwealth Managed Fisheries</td></tr>
<tr><td rowspan="5">Southern Bluefin Tuna Fishery</td><td rowspan="5">✓</td><td rowspan="5">✓</td><td rowspan="5">✓</td><td>Management area</td><td colspan="2">The Southern Bluefin Tuna Fishery (SBTF) covers the entire EEZ around Australia, out to 200 nm from the coast. They do not fish in the Woodside activity area.</td></tr>
<tr><td>Species targeted</td><td>Fishing methods</td><td>Fishing depth</td></tr>
<tr><td>Southern bluefin tuna (<i>Thunnus maccoyii</i>)</td><td>Longline and purse seine fishing.</td><td>Southern bluefin tuna is a pelagic species which can be found to depths of 500 m (AFMA, 2021a)</td></tr>
<tr><td>Fishing effort</td><td colspan="2">Most of the Australian fishing effort is by purse-seine vessels in the Great Australian Bight and waters off South Australia during summer months, and by longline off the New South Wales coastline during winter months (Patterson <i>et al</i>., 2020).
SBTF is a fishery that is shared amongst many countries. Australia currently has a 35% share of the total global allowable catch, and while wild capture fishing in Australia to sell directly to market can occur anywhere throughout the SBTF’s range, currently the vast majority of that quota is value-added through ranching (on-growing the wild captured fish for extra 5-6 months). Ranching requires significant infrastructure, a resident labour force, plus proximity to a fishery able to supply a large quantity of natural feed/sardines (40,000+ tonnes) (for example as available in Port Lincoln). North-west WA is critically important regardless of how the quota is fished because of the proximity to the single spawning ground of this global roaming species.
The stock remains classified as overfished.</td></tr>
<tr><td>Active licences/vessels</td><td colspan="2">Seven purse seine vessels, 20 longline vessels (Patterson <i>et al</i>., 2020).</td></tr>
<tr><td>Western Skipjack Tuna Fishery</td><td>✓</td><td>✓</td><td>✓</td><td>Management area</td><td colspan="2">The combined western and eastern skipjack tuna (<i>Katsuwonus pelamis</i>) fisheries (STF) encompass the entire Australian EEZ. The Western Skipjack Tuna Fishery (WSTF) extends westward from the SA/Victorian border across the Great Australian Bight and around the west coast of WA to the Cape York Peninsula.</td></tr>
</table>

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<table>
<tr><th rowspan="2">Fishery</th><th colspan="3">Woodside Activity Area</th><th rowspan="2" colspan="3">Description</th></tr>
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<tr><td>Western skipjack tuna (<i>Katsuwonus pelamis</i>)</td><td>Fishers use purse seine gear (about 98% of catch) and sometimes pole and line when fishing for skipjack tuna.</td><td>Western skipjack tuna is a pelagic species that can be found to depths of 260 m (AFMA, 2021b).</td></tr>
<tr><td>Fishing effort:</td><td colspan="2">The Skipjack Tuna Fishery (STF) has not been actively fished since the 2008-2009 fishing season (Patterson <i>et al</i>., 2020). The management arrangements for this fishery will be reviewed if active boats re-enter the fishery.</td></tr>
<tr><td>Active licences/vessels:</td><td colspan="2">No active vessels operating since 2009.</td></tr>
<tr><td rowspan="5">Western Tuna and Billfish Fishery</td><td rowspan="5">✓</td><td rowspan="5">✓</td><td rowspan="5">✓</td><td>Management area</td><td colspan="2">The Western Tuna and Billfish Fishery (WTBF) extends to the Australian EEZ boundary in the Indian Ocean.</td></tr>
<tr><td>Species targeted</td><td>Fishing methods</td><td>Fishing depth</td></tr>
<tr><td>Bigeye tuna (<i>Thunnus obesus</i>)
Yellowfin tuna (<i>Thunnus albacares</i>)
Swordfish (<i>Xiphias gladius</i>)
Albacore (<i>Thunnus alalonga</i>)
Striped marlin (<i>Kajikia audax</i>)</td><td>Fishers mainly use pelagic longline fishing gear to catch the targeted species. Minor line (including handline, troll, rod and reel) can also be used.</td><td>Species have a broad depth distribution, with tuna occurring at 150 – 300 m, striped marlin at 150 m and swordfish at up to 600 m (BRS, 2007).</td></tr>
<tr><td>Fishing effort:</td><td colspan="2">The WTBF operates in Australia’s EEZ and high seas of the Indian Ocean. Fishing effort in recent years has been concentrated off south-west WA, with occasional activity off SA.</td></tr>
<tr><td>Active licences/vessels:</td><td colspan="2">Two pelagic longline vessels and two minor longline vessels (Patterson <i>et al</i>., 2020).</td></tr>
<tr><td>Western Deepwater Trawl Fishery</td><td></td><td></td><td>✓</td><td>Management area</td><td colspan="2">The Western Deepwater Trawl Fishery (WDTF) is located in deep water off WA, from the line approximating the 200 m isobath to the edge of the Australian Fishing Zone (AFZ).</td></tr>
</table>

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<tr><td></td><td></td><td></td><td></td><td>More than 50 species, historically dominated by six commercial finfish species or species groups:
Orange roughy (<i>Hoplostethus atlanticus</i>)
Oreos (Oreosomatidae)
Boarfish (Pentacerotidae)
Eteline snapper (Lutjanidae: Etelinae)
Apsiline snapper (Lutjanidae: Apsilinae)
Sea bream (Lethrinidae)</td><td>Demersal trawl.</td><td>Water deeper than 200 m, stakeholder consultation has indicated that this may be to depths of 800 m.</td></tr>
<tr><td></td><td></td><td></td><td></td><td>Fishing effort:</td><td colspan="2">The number of vessels active in the fishery and total hours trawled have fluctuated from year to year. Notably, total hours trawled were relatively high for a brief period during the early 2000s when fishers targeted ruby snapper and deepwater bugs (Patterson <i>et al</i>., 2020). Total fishing effort has been variable but relatively low since then. Effort in 2018-2019 (492 trawl hours) was less than half that of 2017-2018 (1108 trawl hours) (Patterson <i>et al</i>., 2020).</td></tr>
<tr><td></td><td></td><td></td><td></td><td>Active licences/vessels:</td><td colspan="2">One active vessel in 2018-2019 (Patterson <i>et al.</i>, 2020).</td></tr>
<tr><td>North-west Slope Trawl Fishery</td><td>✓</td><td>✓</td><td></td><td>Management area</td><td colspan="2">The North-west Slope Trawl Fishery (NWSTF) extends, from 114 °E to 125 °E, from the 200 m isobath to the outer limit of the AFZ (200 nm from the coastline, which is the boundary of the Australian EEZ).</td></tr>
<tr><td></td><td></td><td></td><td></td><td>Species targeted</td><td>Fishing methods</td><td>Fishing depth</td></tr>
<tr><td></td><td></td><td></td><td></td><td>Australian scampi (<i>Metanephrops australiensis</i>) and smaller quantities of velvet and Boschma’s scampi (<i>M. velutinus</i> and <i>M. boschmai</i>)
Mixed snappers have historically been an important component of the catch.</td><td>Demersal trawl.</td><td>Typically at depths of 350 to 600 m (Patterson <i>et al</i>., 2017), however stakeholder consultation has indicated that this may be to depths of 800 m.</td></tr>
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<tr><td rowspan="2"></td><td rowspan="2"></td><td rowspan="2"></td><td rowspan="2"></td><td>Fishing effort:</td><td colspan="3">The NWSTF commenced in 1985 and the number of active vessels peaked at 21 in the 1986-1987 season and declined through the 1990s before increasing to 10 vessels in 2000-2001 and 2002-2002 seasons. Four vessels operated in the 2017-2018 and 2018-2019 seasons (Patterson <i>et. al</i>. 2020).
Fishing for scampi occurs over soft, muddy sediments or sandy habitats, using demersal trawl gear on the continental slope (Patterson <i>et al</i>., 2017).</td></tr>
<tr><td>Active licences/vessels:</td><td colspan="3">Four vessels (Patterson <i>et. al</i>., 2020).</td></tr>
<tr><td colspan="8">State Managed Fisheries</td></tr>
<tr><td rowspan="4">Pilbara Fish Trawl (Interim) Managed Fishery</td><td rowspan="4"></td><td rowspan="4">✓</td><td rowspan="4"></td><td>Management area</td><td colspan="3">The Pilbara Trawl (Interim) Managed Fishery is of high intensity and is divided into two zones and an area governed by Schedule 5 (prohibited to trawling). In addition to the Prohibited Trawl Fishing area, no fish trawl units are allocated for use in Zone 1 or Areas 3 and 6 of Zone 2 (which comprises six management areas) (Newman <i>et al</i>., 2020a). No fish trawl units have been allocated for use in Area 6 of Zone 2 since the management plan commenced operation in 1998.</td></tr>
<tr><td colspan="2">Species targeted</td><td>Fishing methods</td><td>Fishing depth</td></tr>
<tr><td colspan="2">The Pilbara Fish Trawl (Interim) Managed Fishery (PFTIMF) targets more than 50 scalefish species.
The five main demersal scalefish species landed by the fisheries in the Pilbara region are blue-spotted emperor, crimson snapper, rosy threadfin bream, red emperor and goldband snapper in 2018 (Newman <i>et al</i>., 2020a).</td><td>Demersal trawl.</td><td>The Pilbara Fish Trawl Fishery lands the largest component of the catch and operates in waters between 50 and 200 m water depth (Allen <i>et al</i>., 2014, Newman et al. 2015). Stakeholders have advised that trawling can occur in depths of up to approximately 800 m.</td></tr>
<tr><td>Fishing effort:</td><td colspan="3">Based on State of the Fisheries annual reports provided by DPIRD, catch trends are seen to be increasing over the past reporting years:</td></tr>
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<tr><td rowspan="2"></td><td rowspan="2"></td><td rowspan="2"></td><td rowspan="2"></td><td></td><td colspan="3">Pilbara Trawl (Interim) Managed Fishery caught 1996 t in 2018-19, 1780 t in 2017-18, 1529 t in 2016-17, 1172 t in 2015-16, 1105 t in 2014-15.</td></tr>
<tr><td>Active licences/vessels:</td><td colspan="3">Two Pilbara Trawl (Interim) Managed Fishery vessels in 2017 (Newman <i>et al</i>., 2020a).
Active vessels data are confidential as there were fewer than three vessels in the Pilbara Fish Trawl Interim Managed Fishery (Newman <i>et al</i>., 2020a).</td></tr>
<tr><td rowspan="4">Pilbara Trap Managed Fishery</td><td rowspan="4"></td><td rowspan="4">✓</td><td rowspan="4">✓</td><td>Management area</td><td colspan="3">The Pilbara Trap Fishery covers the area from Exmouth northwards and eastwards to the 120° line of longitude, and offshore as far as the 200 m isobath. Like the trawl fishery, the trap fishery is also managed using input controls in the form of individual transferable effort allocations monitored with a satellite-based vessel management system. The fishery includes six licences allocated to three vessels, operating principally from Onslow.</td></tr>
<tr><td colspan="2">Species targeted</td><td>Fishing methods</td><td>Fishing depths</td></tr>
<tr><td colspan="2">Pilbara Trap Managed Fishery catch is made up of around 45-50 different fish species.
The four main species landed by the fisheries in the Pilbara region are blue-spotted emperor, red emperor, goldband snapper and Rankin cod.</td><td>Demersal fish traps.</td><td>Greatest effort in waters less than 50 m depth targeting high value species such as red emperor and goldband snapper.</td></tr>
<tr><td>Fishing effort</td><td colspan="3">Based on State of the Fisheries annual reports provided by DPIRD, catch trends are seen to be increasing over the past reporting years:
Pilbara Trap Managed Fishery caught 563 t in 2018-19, 573 t in 2017-18, 495 t in 2016-17, 510 t in 2015-16, 268 t in 2014-15.
In 2018, the total catch for the Pilbara Trap Managed Fishery was 563 t, making up 21% of the total catch by the Pilbara Demersal Scale Fishery (Newman <i>et al</i>., 2019).</td></tr>
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<tr><td></td><td></td><td></td><td></td><td>Active licences/vessels</td><td colspan="3">In the 2019 season, there were six licences in the Pilbara Trap Managed Fishery, (Newman <i>et al</i>., 2020a). Active vessels data are confidential as there were fewer than three vessels in the Pilbara Trap Managed Fishery (Newman <i>et al</i>., 2019).</td></tr>
<tr><td rowspan="4">Pilbara Line Managed Fishery</td><td rowspan="4"></td><td rowspan="4">✓</td><td rowspan="4">✓</td><td>Management area</td><td colspan="3">The Pilbara Line Managed Fishery boat licences are permitted to operate anywhere within "Pilbara waters", bounded by a line commencing at the intersection of 21°56’S latitude and the high water mark on the western side of the North-west Cape on the mainland of WA; west along the parallel to the intersection of 21°56’S latitude and the boundary of the AFZ and north to longitude 120°E.</td></tr>
<tr><td colspan="2">Species targeted</td><td>Fishing method</td><td>Fishing depths</td></tr>
<tr><td colspan="2">The Pilbara Line Managed Fishery catch is made up around 45-50 different fish species.
The Pilbara Line Managed Fishery targets similar demersal species to the Pilbara Trap and Trawl fisheries, as well as some deeper offshore species such as ruby snapper and eightbar grouper
The Pilbara Line Managed Fishery operates on an exemption basis that enables licence holders to fish for any nominated five-month block during the year.</td><td>Demersal long line.</td><td>Pilbara Line Fishing Depth: Operates up to a depth of 600 m.</td></tr>
<tr><td>Fishing effort</td><td colspan="3">Based on State of the Fisheries annual reports provided by DPIRD, catch trends are seen to be increasing over the past reporting years:
Pilbara Line Managed Fishery caught 93 t in 2018-19, 143 t in 2017-18, 126 t in 2016-17, 97 t in 2015-16, 40 t in 2014-15.
The total catch in 2018 for the Pilbara Line Managed Fishery was 93 t, making up 3% of the total catch by the Pilbara Demersal Scalefish Fishery (Newman <i>et al</i>., 2019).</td></tr>
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Fishery	**Woodside Activity Area**			**Description**		
	Browse	**NWS/S**	**NW Cape**			
				Active licences/vessels	In the 2018 season there are nine individual licences in the Pilbara Line Fishery, held by seven operators. Active vessels data is confidential as there were fewer than three vessels in the Pilbara Line Fishery (Newman *et al*., 2018).	
Mackerel Managed Fishery	✓	✓	✓	**Management 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).	
				Species targeted	**Fishing methods**	**Fishing depth**
				Spanish mackerel (*Scomberomorus commerson*) Grey mackerel (*S. semifasciatus*) Other species from the genus *Scomberomorus*	Near-surface trawling gear. Jig fishing.	Previous engagement with WAFIC suggests that the depth of fisheries may extend to 70 m.
				Fishing effort:	Most of the catch is taken from waters off the Kimberley coasts (Lewis and Brand-Gardner, 2018), reflecting the tropical distribution of mackerel species (Molony *et al.*, 2015). Most fishing activity occurs around the coastal reefs of the Dampier Archipelago and Port Hedland area, with the seasonal appearance of mackerel in shallower coastal waters most likely associated with feeding and gonad development before spawning (Mackie *et al.*, 2003). Based on State of the Fisheries annual reports provided by DPIRD, catch trends are as follows: 213 t in 2018-19 (the lowest on record (Lewis *et al*., 2020), 283 t in 2017-18, 276 t in 2016-17, 302 t in 2015-16, 322 t in 2014-15.	
				Active licences/vessels:	Fifteen boats fished in 2018, with approximately 35-40 people directly employed in the Mackerel Managed Fishery, primarily from May-November (Lewis *et al*., 2020).	
Marine Aquarium Managed Fishery	✓	✓	✓	**Management area**	The Marine Aquarium Managed Fishery is able to operate in all State waters. The fishery is typically more active in waters south of Broome and higher levels of effort around the Capes region, Perth, Geraldton, Exmouth, Dampier and Broome (Newman *et al.*, 2020b).	
				Species targeted	**Fishing methods**	**Fishing depth**

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Fishery	Woodside Activity Area			Description		
	Browse	NWS/S	NW Cape			
				Finfish, hard coral, soft coral, tridacnid clams, syngnathids (seahorses and pipefish), other invertebrates (including molluscs, crustaceans, echinoderms etc.), algae, seagrasses and 'live rock'.	The fishery is diver-based, which typically restricts effort to safe diving depths (less than 30 m).	Less than 30 m, as advised by WAFIC.
				Fishing effort:	Total catch for the Marine Aquarium Managed Fishery in 2018 was 156,188 fishes, 32.025 t of coral, live rock and living sand and 176.02 L of marine plants and live feed.	
				Active licences/vessels:	Eleven licences were active in 2019 (Newman *et al.*, 2020b).	
Beche-de-mer Fishery	✓	✓	✓	**Management area**	Fishing occurs in the northern half of WA from Exmouth Gulf to the NT border and is managed under Ministerial Exemptions.	
				Species targeted	**Fishing methods**	**Fishing depth**
				The sea cucumber fishery targets two main species: sandfish (*Holothuria scabra*) and redfish (*Actinopyga echinites*).	Diving	The targeted species typically inhabit nearshore in shallow depths.
				Fishing effort	Based on State of the Fisheries annual reports provided by DPRID, catch trends are as follows: 62t in 2018 (Gaughan and Santoro, 2020), 135t in 2017, 93t in 2016, 38t in 2015	
				Active licences/vessels	Six active licences in 2019 (Hart *et al*., 2019). Active vessels data is confidential as there were fewer than three vessels.	
Onslow Prawn Managed Fishery		✓		**Management area**	The Onslow Prawn Managed Fishery encompasses a portion of the continental shelf off the Pilbara.	
				Species targeted	**Fishing methods**	**Fishing depth**

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<tr><td rowspan="3"></td><td rowspan="3"></td><td rowspan="3"></td><td rowspan="3"></td><td colspan="2">The fishery targets:
Western king prawns (<i>Penaeus esculentus</i>)
Brown tiger prawns (<i>Penaeus esculentus</i>)
Blue endeavour prawns (<i>Metapenaeus endeavouri</i></td><td>Low opening, otter prawn trawl systems.</td><td>Prawn trawling takes place in water depths of approximately 30 metres and less (licence holder feedback). Fishery and or fishing activity overlaps the Beadon Creek dredging scope (Sporer <i>et al</i>., 2015).</td></tr>
<tr><td>Fishing effort:</td><td colspan="3">The total landings for the Onslow Prawn Managed Fishery in 2018 were less than 60 t below the target catch range (Kangas <i>et al</i>., 2020a).</td></tr>
<tr><td>Active licences/vessels:</td><td colspan="3">One vessel (Kangas <i>et al</i>., 2020a).</td></tr>
<tr><td rowspan="5">Pearl Oyster Managed Fishery</td><td rowspan="5">✓</td><td rowspan="5">✓</td><td rowspan="5">✓</td><td>Management area</td><td colspan="3">Located in shallow coastal waters with the pearl oyster managed fishery designated by four zones extending from Exmouth to Kununurra and the seaward boundary demarcated by the 200 nm EEZ.</td></tr>
<tr><td colspan="2">Species targeted</td><td>Fishing methods</td><td>Fishing depth</td></tr>
<tr><td colspan="2">Pearl oysters (<i>Pinctada maxima</i>).</td><td>Drift diving.</td><td>Fishing effort is mostly focussed in shallow coastal waters (10-15 m depth), with a maximum depth of 35 m (Lulofs <i>et al.</i> 2002).</td></tr>
<tr><td>Fishing effort:</td><td colspan="3">In 2018, catch was taken from Zones 2 and 3 with no fishing in Zone 1. The number of pearl oysters caught for 2018-19 was 614,002. Total effort was 15,637 dive hours, this was an increase from 2017 effort of 12,845 hours. No fishing occurred in Zone 1 in 2017 and 2018 (Gaughan and Santoro, 2020).</td></tr>
<tr><td>Active licences/vessels:</td><td colspan="3">15,637 diver hours (Hart <i>et al.</i>, 2020a).</td></tr>
<tr><td></td><td></td><td>✓</td><td>✓</td><td>Management area</td><td colspan="3">The Pilbara Crab Managed Fishery comprises WA waters off the north-western coast of WA north of 23° 34′ south latitude and west of 120° 00′ east longitude. Areas of the fishery north and east of Exmouth and</td></tr>
</table>

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Fishery	**Woodside Activity Area**			**Description**		
	Browse	**NWS/S**	**NW Cape**			
Pilbara Crab Managed Fishery					nearshore are currently closed as per Schedule 2 of the Draft Management Plan for the Pilbara Crab Managed Fishery.	
				Species targeted	**Fishing methods**	**Fishing depth**
				Crabs of the Family Portunidae, excluding crabs of the genus *Scylla*.	Traps.	Up to 50 m deep.
				Fishing effort:	The capacity of the fishery is 600 traps.	
				Active licences/vessels:	No information available at this time.	
South-west Coast Salmon Managed Fishery	✓	✓	✓	**Management area**	The South-west Coast Salmon Managed Fishery operates on various beaches south of the metropolitan area and includes all WA waters north of Cape Beaufort except Geographe Bay.	
				Species targeted	**Fishing methods**	**Fishing depth**
				Western Australian salmon (*Arripis truttaceus*)	Beach seine nets.	Information not available however, species generally found in shallow waters (up to 30 m).
				Fishing effort:	No fishing occurs north of the Perth metropolitan area, despite the managed fishery boundary extending to Cape Beaufort (WA/Northern Territory border), as advised by WAFIC. The 2018 commercial catch was 191 t, with 72% taken by the South West Coast Salmon Managed Fishery, 25% by the South Coast Salmon Managed Fishery and 3% by other fisheries (Duffy and Blay, 2020a).	
				Active licences/vessels:	Six licences.	
	✓	✓	✓	**Management area**	The Specimen Shell Managed Fishery (SSMF) encompasses the entire WA coastline, but effort is concentrated in areas adjacent to the population centres such as Broome, Exmouth, Shark Bay,	

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Fishery	**Woodside Activity Area**			**Description**		
	Browse	**NWS/S**	**NW Cape**			
Specimen Shell Managed Fishery					Geraldton, Perth, Mandurah, the Capes area and Albany (Hart *et al.*, 2020b). There are a number of closed areas where the SSMF is not permitted to operate. These include various marine parks and aquatic reserves, such as Ningaloo Marine Park.	
				Species targeted	**Fishing methods**	**Fishing depth**
				The Specimen Shell Managed Fishery targets the collection of specimen shells for display, collection, cataloguing and sale.	Collection is predominantly by hand when diving to wading in shallow, coastal waters, though in deeper water collection may be conducted by remotely operated vehicles (limited to one per licence).	For collection by hand, (diver-based) this typically restricts effort to safe diving depths (less than 30 m). ROV collection could enable depths up to 300 m (Hart *et al.*, 2017). In the past there has been one licence holder in the Specimen Shell Managed Fishery who has trialled ROV means of shell collection, WAFIC have provided advice that this fishery is no longer active.
				Fishing effort:	Information not available.	
				Active licences/vessels:	In 2018 there were 31 licences with only two divers allowed in the water per licences at one time (Hart *et al.*, 2018). The number of people employed regularly in the fishery is likely to be about 21 (Hart *et al.*, 2018).	
West Australian Abalone Fishery	✓	✓	✓	**Management area**	The Western Australian Abalone Fishery includes all coastal waters from the WA and SA border to the WA and NT border. The fishery is concentrated on the south coast and the west coast.	
				Species targeted	**Fishing methods**	**Fishing depth**
				Greenlip abalone (*Haliotis laevigata*) Brownlip abalone (*Haliotis conicopora*) Roe's abalone (*Haliotis roei*)	Divers.	Distribution to 5 m depth for Roe's abalone and 40 m depth for greenlip / brownlip abalone (DOF, 2011).

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<tr><td rowspan="2"></td><td rowspan="2"></td><td rowspan="2"></td><td rowspan="2"></td><td>Fishing effort:</td><td colspan="3">In 2018, the total commercial catch was 48 t, 1 t less than the catch in each of the last two seasons. No commercial fishing for abalone north of Moore River (Zone 8 of the managed fishery) has occurred since 2011–2012 (Strain <i>et al.</i>, 2018).</td></tr>
<tr><td>Active licences/vessels:</td><td colspan="3">26 vessels active in Roe’s abalone fishery (WAFIC[5]).</td></tr>
<tr><td rowspan="5">West Coast Deep Sea Crustacean Managed Fishery</td><td rowspan="5">✓</td><td rowspan="5">✓</td><td rowspan="5">✓</td><td>Management area</td><td colspan="3">The West Coast Deep Sea Crustacean Managed Fishery extends north from Cape Leeuwin to the WA/NT border in water depths greater than 150 m within the AFZ.</td></tr>
<tr><td colspan="2">Species targeted</td><td>Fishing methods</td><td>Fishing depth</td></tr>
<tr><td colspan="2">The fishery targets deepwater crustaceans. Catches were dominated by crystal crabs of which 99% of their Total Allowable Catch (TAC) was landed (How and Orme, 2020a).
Crystal (snow) crab (<i>Chaceon albus</i>)
Giant (king) crab (<i>Pseudocarcinus gigas</i>)
Champagne (spiny) crabs (<i>Hypothalassia acerba</i>)</td><td>Baited pots, or traps, are operated in long-lines which have between 80 and 180 pots attached to a main line marked by a float at each end.</td><td>Deeper than 150 m (and mostly at depths of between 500 m – 800 m). Most of the commercial Crystal crab catch is taken in depths of 500 m – 800 m (WAFIC[6]).</td></tr>
<tr><td>Fishing effort:</td><td colspan="3">The total landings in 2018 was 168. t. Two vessels operated in the fishery in 2017, using baited pots operated in a longline formation in the shelf edge waters, mostly in depths between 500 and 800 m (How and Orme, 2020a). Fishing effort was concentrated between Fremantle and Carnarvon.</td></tr>
<tr><td>Active licences/vessels:</td><td colspan="3">There were four active vessels in 2018 (How and Orme, 2020a).</td></tr>
</table>

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[5] https://www.wafic.org.au/fishery/roes-abalone-fishery/

[6] https://www.wafic.org.au/fishery/west-coast-deep-sea-crustacean-fishery/

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<table>
<tr><th rowspan="2">Fishery</th><th colspan="3">Woodside Activity Area</th><th rowspan="2" colspan="3">Description</th></tr>
<tr><th>Browse</th><th>NWS/S</th><th>NW Cape</th></tr>
<tr><td rowspan="5">Abrolhos Islands and Mid-West Trawl Fishery</td><td rowspan="5"></td><td rowspan="5"></td><td rowspan="5">✓</td><td>Management area</td><td colspan="2">The Abrolhos Islands and Mid-West Trawl Fishery (AIMWTMF) operates around the Abrolhos Islands within the SWMR.</td></tr>
<tr><td>Species targeted</td><td>Fishing methods</td><td>Fishing depth</td></tr>
<tr><td>Saucer scallops (<i>Ylistrum balloti,</i> formerly <i>Amusium balloti</i>)</td><td>Trawl.</td><td>Information not available, however, the species occurs at depth of around 30-60 m and therefore fishing effort would likely be at these depths (Himmelman <i>et al</i>., 2009).</td></tr>
<tr><td>Fishing effort:</td><td colspan="2">The scallop landings in the AIMWTMF were 31.0 t meat weight (154.8 t whole weight). Between 2011 and 2015, the annual pre-season surveys showed very low recruitment (1-year old), as a result of the 2011 extreme marine heatwave and subsequent poor pawning stock (Kangas <i>et al.</i>, 2020b). The fishery was closed between 2011 and 2016.</td></tr>
<tr><td>Active licences/vessels:</td><td colspan="2">Information about licences or vessels is not available but the Department of Primary Industry and Regional Development reported 774 t of catch from this fishery in the 2019 annual report (DPIRD, 2019).</td></tr>
<tr><td rowspan="4">Broome Prawn Managed Fishery</td><td rowspan="4">✓</td><td rowspan="4"></td><td rowspan="4"></td><td>Management area</td><td colspan="2">The Broome Prawn Managed Fishery (BPMF) operates off Broome and forms part of the North Coast Prawn Fishery.</td></tr>
<tr><td>Species targeted</td><td>Fishing methods</td><td>Fishing depth</td></tr>
<tr><td>Western king prawn (<i>Penaeus latisulcatus</i>)
Coral prawn</td><td>Trawl.</td><td>Trawling is generally in waters between 30 and 60 m deep, however can occur down to 100 m (DOEH, 2004).</td></tr>
<tr><td>Fishing effort:</td><td colspan="2">BPMF recorded extremely low fishing effort in 2018. Only two vessels undertook trial fishing to investigate whether the catch rates were sufficient for commercial fishing. This resulted in negligible landings of Western king prawn (Kangas <i>et al</i>., 2020a).</td></tr>
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Fishery	Woodside Activity Area			Description		
	Browse	NWS/S	NW Cape			
				Active licences/vessels:	Two vessels conducting fishing trial operated in 2018 (Kangas *et al*., 2020a).	
Exmouth Gulf Prawn Managed Fishery			✓	**Management area**	The estimated employment in the fishery in 2017 was 18 people including skippers and other crew (Kangas *et al*., 2018). The fishery occupies a total area of 4000 km^2, with only half of this area being trawled (Fletcher and Santoro, 2015).	
				Species targeted	**Fishing methods**	**Fishing depth**
				Western king prawn (*Penaeus latisulcatus*) Brown tiger prawn (*Penaeus esculentus*) Blue endeavour prawn (*Metapenaeus endeavouri*) Banana prawn (*Penaeus merguinensis*)	Trawl.	Information not available.
				Fishing effort:	The total landings of prawns in 2018 were 880 t (Kangas *et al*., 2020a). In the 2016 season, a fishing effort of about 23,000 hours resulted in a catch of 822 t.	
				Active licences/vessels:	The precise number of vessels is unreported. Eighteen people were said to be employed in this fishery in 2018 (Kangas *et al.*, 2019); however, in 2013 it was reported that 18 skippers as well as other crew and support staff were employed (WAFIC[7]).	
Gascoyne Demersal Scalefish Managed Fishery			✓	**Management area**	The Gascoyne Demersal Scalefish Fishery (GDSF) is located between the southern Ningaloo Coast to south of Shark Bay (23°07.30'S to 26°.30'S) with a closure area at Point Maud to Tantabiddi (21°56.30'S) (WAFIC[8]).	
				Species targeted	**Fishing methods**	**Fishing depth**

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[7] https://www.wafic.org.au/fishery/exmouth-gulf-prawn-fishery/

[8] https://www.wafic.org.au/fishery/gascoyne-demersal-scalefish-fishery/

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Fishery	Woodside Activity Area			Description		
	Browse	NWS/S	NW Cape			
				Pink snapper (*Chrysophrys auratus*) Goldband snapper (*Pristipomoides multidens*) Red emperor (*Lutjanus sebae*) Cods (*Gadus morhua*) Emperors (*Lethrinus miniatus)*	Mechanised handlines.	Information not available.
				Fishing effort:	The GDSF reported a total commercial catch of 210 t in 2017-18.	
				Active licences/vessels:	In 2018, 13 vessels fished during the season, in the 2017 season there were 16 vessels (Gaughan and Santoro, 2018).	
Kimberley Developing Mud Crab Fishery	✓			**Management area**	The Kimberley Developing Mud Crab Fishery is one of two small trap-based crab fisheries that exist in the North Coast Bioregion between Cambridge Gulf and Broome (Gaughan and Santoro, 2018).	
				Species targeted	**Fishing methods**	**Fishing depth**
				Brown mud crab (*Scylla olivacea*) Green mud crab (*Scylla serrata*)	Trap.	Information not available.
				Fishing effort:	The catch landed represents all commercially caught mud crabs landed in WA for 2018. A nominal catch rate of 0.66 kg/traplift was recorded for 2018, which is a 28% decrease from 2017 but remains above the harvest strategy threshold (Johnston *et al*., 2020).	
				Active licences/vessels:	There are currently three licences issued to commercial operators (600 trap limit), and three exemptions issued to Indigenous groups (total of 210 traps currently allocated of a maximum 600 traps) (Johnston *et al*., 2020).	
Nickol Bay Prawn Managed Fishery		✓		**Management area**	The Nickol Bay Prawn Managed Fishery operates in nearshore and offshore waters of the Pilbara region along the NWS.	
				Species targeted	**Fishing methods**	**Fishing depth**

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Fishery	**Woodside Activity Area**			**Description**		
	Browse	**NWS/S**	**NW Cape**			
				Banana prawn (*Penaeus merguiensis*) Western king prawn (*Penaeus latisulcatus*) Brown tiger prawn (*Penaeus esculentus*) Blue endeavour prawn (*Metapenaeus endeavouri*)	Trawl.	Information not available.
				Fishing effort:	Trawling has been reported to occur at several locations along the Pilbara coast to the east of the Burrup Peninsula, including within the waters of Nickol Bay (Fletcher and Santoro, 2015). The total landings for the 2018 season were 81 t. Fishing effort was less than half at 138 days, compared to 281 boat days in 2017 (Kangas *et al*., 2020a).	
				Active licences/vessels:	The precise number of vessels is unreported, though low effort produced a catch of 17 t in 2016 (Kangas *et al*., 2018).	
Northern Demersal Scalefish Managed Fishery	✓			**Management area**	The fishery is divided into two fishing areas: an inshore sector (Area 1) and an offshore sector (Area 2) (Newman *et al*., 2018). Area 1 permits line fishing only, between the high water mark and the 30 m isobath. Area 2 permits handline, dropline and fish trap fishing methods and is further divided into zones. Zone A is an inshore area, Zone B comprises the area with most historical fishing activity, and Zone C is an offshore deep slope area representing waters deeper than 200 m (Fletcher *et al*., 2017).	
				Species targeted	**Fishing methods**	**Fishing depth**
				Goldband snapper (*Pristipomoides multidens*) Blue-spotted emperor (*Lethrinus punctulantus*) Red emperor (*Lutjanus sebae*) Rankin cod (*Epinephelus multinotatus*)	Line fishing, handline, dropline and fish trap fishing.	Information not available.

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Fishery	Woodside Activity Area			Description		
	Browse	NWS/S	NW Cape			
				Fishing effort:	In 2018, the fishery reported a total catch of 1297 t. Most of the catch is landed from Zone B, with a catch of 1106 t in 2018. The level of catch in Zone B is the highest reported since zoning was implemented in 2006 (Newman *et al.*, 2019).	
				Active licences/vessels:	Six vessels fished in the 2018 season and at least 20 people were directly employed (Gaughan and Santoro, 2018).	
Octopus Interim Management Fishery				**Management area**	The developing Octopus Fishery operates from Kalbarri Cliffs in the north to Esperance in the south.	
				Species targeted	**Fishing methods**	**Fishing depth**
				Octopus sp. cf. tetricus	Passive shelter pots and active traps.	In inshore waters to a depth of 70 m (DPIRD, 2018).
				Fishing effort:	In 2019, the total commercial octopus catch was 314 t, which was 22% higher than the 2017 catch of 257 t. In 2016, about 200 vessels reported a total catch of 252 t (Hart *et al.*, 2020c).	
				Active licences/vessels:	About 21 vessels fish within the octopus specific fisheries, and about 200 vessels from the West Coast Rock Lobster Fishery catch octopus as bycatch (Gaughan and Santoro, 2018).	
Shark Bay Beach Seine and Mesh Net Managed Fishery				**Management area**	The Shark Bay Beach Seine and Mesh Net Managed Fishery operates from Denham.	
				Species targeted	**Fishing methods**	**Fishing depth**
				Whiting (yellowfin *Sillago schomburgkii* and goldenline *S. analis*) Sea mullet (*Mugil cephalus*) Tailor (*Pomatomus saltatrix*) Western yellowfin bream (*Acanthopagrus australis*)	Beach seine and mesh net.	Information not available.

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<tr><th>Browse</th><th>NWS/S</th><th>NW Cape</th></tr>
<tr><td rowspan="2"></td><td rowspan="2"></td><td rowspan="2"></td><td rowspan="2"></td><td>Fishing effort:</td><td colspan="3">In 2018, the total catch was 176 t (Gaughan and Santoro, 2020). The fishery currently employs about 14 fishers based on the seven fishery licences in operation (WAFIC[9]).</td></tr>
<tr><td>Active licences/vessels:</td><td colspan="3">Six vessels operated employing around 12 fishers (Gaughan and Santoro, 2018).</td></tr>
<tr><td rowspan="5">Shark Bay Crab Managed Fishery</td><td rowspan="5"></td><td rowspan="5"></td><td rowspan="5"></td><td>Management area</td><td colspan="3">The Shark Bay Crab Managed Fishery operates within the NWMR.</td></tr>
<tr><td colspan="2">Species targeted</td><td>Fishing methods</td><td>Fishing depth</td></tr>
<tr><td colspan="2">Blue swimmer crab (<i>Portunus armatus</i>)</td><td>Trap and trawl.</td><td>Information not available.</td></tr>
<tr><td>Fishing effort:</td><td colspan="3">Commercial fishing for blue swimmer crabs in Shark Bay was voluntarily halted by industry in 2012 to facilitate stock rebuilding. The stock is still in a recovery phase; however, the fishery has resumed and reported a total commercial catch of 518 t in the 2017/18 season. The average commercial trap catch rate was 1.5 kg/traplift during 2017/18 (Chandrapavan <i>et al.</i>, 2017).</td></tr>
<tr><td>Active licences/vessels:</td><td colspan="3">The precise number of vessels in the Shark Bay Blue Swimmer Crab Fishery is unreported. There are five crab trap permits. These permits are consolidated onto three active vessels (WAFIC[10]).</td></tr>
<tr><td rowspan="3">Shark Bay Prawn and Scallop Managed Fishery</td><td rowspan="3"></td><td rowspan="3"></td><td rowspan="3"></td><td>Management area</td><td colspan="3">The Shark Bay Prawn Managed Fishery is the highest producing WA fishery for prawns.</td></tr>
<tr><td colspan="2">Species targeted</td><td>Fishing methods</td><td>Fishing depth</td></tr>
<tr><td colspan="2">Western king prawn (<i>Penaeus latisulcatus</i>)
Brown tiger prawn (<i>Penaeus esculentus</i>)</td><td>Low-opening otter trawls.</td><td>Information not available.</td></tr>
</table>

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[9] https://www.wafic.org.au/fishery/inner-shark-bay-scalefish-fishery/

[10] https://www.wafic.org.au/fishery/shark-bay-prawn-and-scallop-managed-fisheries/

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Fishery	Woodside Activity Area			Description		
	Browse	NWS/S	NW Cape			
				Endeavour prawns (*Metapenaeus endeavouri*) Coral prawns (*Metapenaeopsis sp.*) Saucer scallop (*Amusium balloti*)		
				Fishing effort:	The Shark Bay Scallop Managed Fishery is currently in a recovery phase due to the results from the pre-season survey of stock abundance (Fletcher and Santoro, 2015; Kangas *et al.*, 2018).	
				Active licences/vessels:	The precise number of vessels in the Shark Bay Prawn Managed Fishery is unreported; however, about 100 people are employed in this fishery (Gaughan and Santoro, 2018). About 20 skippers and crew are employed in scallop fishing in the Shark Bay and South Coast fisheries across 18 vessels in 2015 (Sporer *et al.*, 2015).	
South Coast Crustacean Managed Fishery	-	-	-	**Management area**	The South Coast Crustacean Managed Fishery comprises four fisheries: the Windy Harbour/Augusta Rock Lobster Managed Fishery, the Esperance Rock Lobster Managed Fishery, the Southern Rock Lobster Pot Regulation Fishery and the South Coast Deep-Sea Crab Fishery.	
				Species targeted	**Fishing methods**	**Fishing depth**
				Southern rock lobster (*Jasus edwardsii*) Western rock lobster (*Panulirus cygnus*) Giant crab (*Pseudocarcinus gigas*) Crystal crab (*Chaceon albus*) Champagne crab (*Hypothalassia acerba*)	Pots.	Information not available.
				Fishing effort:	The South Coast Crustacean Managed Fishery reported a total catch of 101.2 t in 2018 season and the value of the fishery for 2017/2018 was about $5.9 million (Howe and Orme, 2020b).	
				Active licences/vessels:	The number of vessels is unknown; however, a total of 1977 pots are licensed to be used.	
	-	-	-	**Management area**	The fishery is active in coastal waters between Cape Leeuwin and the South Australia border. Landings are primarily at Albany, Bremer Bay and Esperance (Norriss and Blazeski, 2020).	

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<tr><th>Browse</th><th>NWS/S</th><th>NW Cape</th></tr>
<tr><td rowspan="4">South Coast Purse Seine Managed Fishery</td><td rowspan="4"></td><td rowspan="4"></td><td rowspan="4"></td><td colspan="2">Species targeted</td><td>Fishing methods</td><td>Fishing depth</td></tr>
<tr><td colspan="2">Small pelagic finfish such as pilchards and yellowtail scad using purse seine nets from vessels.
Sandy sprat (<i>Hyperlophus vittatus</i>)
Blue sprat (<i>Spratelloides robustus</i>)</td><td>Purse seine.</td><td>Information not available.</td></tr>
<tr><td>Fishing effort:</td><td colspan="3">In the 2017/18 season the total catch effort was 2,168 t (Norriss and Blazeski, 2020).</td></tr>
<tr><td>Active licences/vessels:</td><td colspan="3">Nine active vessels in 2017/18 (Norriss and Blazeski, 2020).</td></tr>
<tr><td rowspan="5">South-west Trawl Managed Fishery</td><td rowspan="5">-</td><td rowspan="5">-</td><td rowspan="5">-</td><td>Management area</td><td colspan="3">The South-west Trawl Managed Fishery is a multi-species fishery and includes two of WA's smaller scallop fishing grounds at Fremantle and north of Geographe Bay (Fairclough and Walters, 2018).</td></tr>
<tr><td colspan="2">Species targeted</td><td>Fishing methods</td><td>Fishing depth</td></tr>
<tr><td colspan="2">Scallops (<i>Ylistrum balloti,</i> formerly <i>Amusium balloti</i>) and associated by-products
Western king prawn (<i>Penaeus latisulcatus</i>)
In years of low scallop catches licencees may use other trawl gear to target fin-fish species.</td><td>Trawl.</td><td>Information not available.</td></tr>
<tr><td>Fishing effort:</td><td colspan="3">Effort in the fishery is highly variable and typically fluctuates in response to recruitment variability in saucer scallops and prawns. The fishery was not active in 2015 or 2016 (Fairclough and Walters, 2018).</td></tr>
<tr><td>Active licences/vessels:</td><td colspan="3">Only one boat fished in 2018 for a total of 5 boat days for minimal catch (Fairclough and Walters, 2018).</td></tr>
</table>

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Fishery	Woodside Activity Area			Description			
	Browse	NWS/S	NW Cape				
The South Coast Salmon Managed Fishery	-	-	-	**Management area**	The South Coast Salmon Managed Fishery is one of two fisheries operating in the South Coast Bioregion that target nearshore and estuarine finfish.		
				Species targeted		**Fishing methods**	**Fishing depth**
				Western Australian salmon (*Arripis truttaceus*) Southern school whiting (*Sillago bassensis*) Australian herring (*Arripis georgianus*) King George whiting (*Sillaginodes punctatus*) Sea mullet (*Mugil cephalus*) Estuary cobbler (*Cnidoglanis macrocephalus*) Black bream (*Acanthopagrus butcheri*)		Beach seines, haul nets and gill nets.	Information not available.
				Fishing effort:	The total catch for 2018 was 243 t (Duffy and Blay, 2020b).		
				Active licences/vessels:	Number of vessels is unknown; however, 12 commercial fishers were employed in 2018 (Duffy and Blay, 2020b).		
West Coast Beach Bait Managed Fishery	-	-	-	**Management area**	Primarily active in the Bunbury areas in the SWMR.		
				Species targeted		**Fishing methods**	**Fishing depth**
				Whitebait		Beach-based haul nets.	Information not available.
				Fishing effort:	In recent years the fishery is primarily active in the Bunbury area. Total catch of whitebait in 2015 was 40.2 t (Duffy and Blay, 2020c).		

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Fishery	Woodside Activity Area			Description		
	Browse	NWS/S	NW Cape			
				Active licences/vessels:	Number of vessels is unknown; however, only one license was issued (DPIRD, 2019).	
West Coast Demersal Gillnet and Demersal Longline (Interim) Managed Fishery	-	-	-	**Management area**	The West Coast Demersal Gillnet and Demersal Longline (Interim) Managed Fishery (WCDGDLF) is part of the Temperate Demersal Gillnet and Demersal Longline Fishery (TDGDLF), which operates between 26° and 33° S, and the Joint Authority Southern Demersal Gillnet and Demersal Longline Managed Fishery (JASDGDLF), which operates from 33° S to the WA/SA border (Braccini and Blay, 2020).	
				Species targeted	**Fishing methods**	**Fishing depth**
				Gummy shark (*Mustelus antarcticus*) Dusky shark (*Carcharhinus obscurus*) Whiskery shark (*Furgaleus macki*) Sandbar shark (*C. plumbeus*)	Gillnet and longline.	Information not available.
				Fishing effort:	Catch estimated annual value of the fishery was $0.2 million for 2017 to 2018 (Braccini and Blay, 2020).	
				Active licences/vessels:	Vessel numbers are unknown; however, 17 interim managed fishery permits were held in 2019 (DPIRD, 2019) and between 18 and 21 skippers and crew were employed between 2016 and 2017.	
West Coast Demersal Scalefish Fishery	-	-	-	**Management area**	These fisheries include the West Coast Demersal Scalefish (Interim) Managed Fishery (51 boats), the West Coast Demersal Gillnet and Demersal Longline (Interim) Managed Fishery and the temperate Demersal Gillnet and Demersal Longline Fisheries. The West Coast Demersal Scalefish Managed Fishery is the main commercial fishery that targets demersal species in the West Coast Bioregion. It encompasses the waters from just south of Shark Bay down to just east of Augusta and extends seaward to the 200 nm boundary. The fishery is divided into four inshore management areas and one offshore management area.	
				Species targeted	**Fishing methods**	**Fishing depth**
				Baldchin groper (*Choerodon rubescens*) Dhufish (*Glaucosoma hebraicum*) Pink snapper (*Pagrus auratus*)	Lines.	Inshore species – 20 to 250 m water depth.

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Fishery	Woodside Activity Area			Description		
	Browse	NWS/S	NW Cape			
						Offshore species – more than 250 m water depth.
				Fishing effort:	In 2016, the West Coast Demersal Scalefish (interim) Managed Fishery reported a total catch of 256 t.	
				Active licences/vessels:	The precise number of vessels in the West Coast Demersal Scalefish Fisheries is unreported; however, it is restricted to 60 interim managed fishery permit holders.	
West Coast Purse Seine Managed Fishery	-	-	-	**Management area**	Located in waters from Cape Bouvard extending to Lancelin.	
				Species targeted	**Fishing methods**	**Fishing depth**
				Small pelagic finfish such as: Scaly mackerel (*Sardinella lemuru*) Pilchards (*Sardinops sagax*) Australian anchovy (*Engraulis australis*) Yellowtail scad (*Trachurus novaezelandiae*) Maray (*Etrumeus teres*)	Purse seine.	Information not available.
				Fishing effort:	Information not available	
				Active licences/vessels:	Seven vessels in 2017 (Gaughan and Santoro, 2018).	
West Coast Rock Lobster Managed Fishery			✓	**Management area**	The West Coast Rock Lobster Fishery operates from Shark Bay south to Cape Leeuwin. The fishery is managed using zones, seasons and total allowable catch. The recreational fishery targets the western rock lobsters using baited pots and by diving between North-west Cape and Augusta.	

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<tr><td rowspan="4"></td><td rowspan="4"></td><td rowspan="4"></td><td rowspan="4"></td><td colspan="2">Species targeted</td><td>Fishing methods</td><td>Fishing depth</td></tr>
<tr><td colspan="2">Western rock lobster (<i>Panulirus cygnus)</i></td><td>Baited pots.</td><td>Less than 20 m.</td></tr>
<tr><td>Fishing effort:</td><td colspan="3">In 2018, 234 vessels reported a total catch of 6400 t in 2017 (de Lestang <i>et al</i>., 2018). In 2016, 226 vessels reported a total catch of 6,086 t (Gaughan and Santoro, 2018).</td></tr>
<tr><td>Active licences/vessels:</td><td colspan="3">234 vessels operated in 2017 and 233 vessels operated in 2018 (Gaughan and Santoro, 2018).</td></tr>
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11.5.2 Aquaculture

Aquaculture operations in the northwest are typically restricted to inland and shallow coastal waters.

West Coast Bioregion

Aquaculture activities in the West Coast bioregion, defined by the Department of Primary Industries and Regional Development (DPIRD) (as the government body responsible management of primary industries in WA) are focused on blue mussels and edible oysters (mainly in Cockburn Sound) and marine algae for production of beta-carotene, used as a food additive and as a nutritional supplement. Offshore marine finfish production is also being developed, initially focusing on yellowtail kingfish.

There is also an emerging black pearl industry (from the *Pinctada margaritifera* oyster) in the Abrolhos Islands. As well as expansion in the production of Akoya pearls (small white pearls from *Pinctada fucata martensi*), *Pinctada albina* (small, yellow pearls) and *Pteria penguin*, which are often used to produce half (mabe) pearls in pink and bluish shades.

Aquaculture licences for producing coral and live rock (pieces of old coral reefs colonised by marine life, such as beneficial bacteria, for aquariums) at the Abrolhos Islands have also been issued and other applications are being assessed.

Gascoyne Coast Bioregion

In the Gascoyne Coast bioregion, aquaculture activities are focused on the blacklip oyster (*Pinctada margaritifera*) and Akoya pearl oyster (*Pinctada imbricata*) (Gaughan and Santoro, 2020). Several hatcheries supply *P. margaritifera* juveniles to the region's developing black pearl farms.

Other aquaculture developments in the Gascoyne Coast bioregion include emerging producers of coral and live rock species for aquariums.

North Coast Bioregion

Aquaculture activities in the North Coast bioregion is dominated by the production of pearls. A large number of pearl oysters for seeding are obtained from wild stocks and supplemented by hatchery produced oysters, with major hatcheries operating at Broome and around the Dampier Peninsula (Gaughan and Santoro, 2018). Primary spawning of the pearl oyster occurs from mid-October to December. A smaller secondary spawning occurs in February and March (Gaughan and Santoro, 2020).

Other aquaculture developments in the North Coast include emerging producers of coral and live rock species for aquariums as well as barramundi (*Lates calcarifer)* farms and microalgae culturing for Omega-3, biofuels and protein biomass (Gaughan and Santoro, 2020).

11.6 Fisheries – Traditional

Traditional or customary fisheries are typically restricted to shallow coastal waters and/or areas with structures such as reef.

Dugong, fish and marine turtles that move between coastal and Commonwealth waters are important components of the Aboriginal people's culture and diet. Aboriginal people continue to actively manage their sea country in coastal waters of WA in order to protect and manage the marine environment, its resources and cultural values.

Indonesian fishers can fish within designated areas under the Australia-Indonesia Memorandum of Understanding regarding the Operations of Indonesian Traditional Fishermen in Areas of the Australian Fishing Zone and Continental Shelf – 1974 (MoU 74). Traditional fishing is allowed within the MoU Box (**Figure 11-1)**, which encompasses: Ashmore Reef (Pulau Pasir), Cartier Island (Pulau Baru), Seringapatam Reef (Afringan), Scott Reef (Pulau Dato) and Browse Island (Berselan). Restrictions have since been introduced around Ashmore Reef and Cartier Island following their

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designation as Nature Reserves under the Commonwealth's *National Parks and Wildlife Conservation Act 1975* in 1983 and 2000, respectively.

The MoU allows Indonesian fishers to fish in designated areas using traditional methods only. These methods include reef gleaning, free-diving, hand lining and other non-mechanised methods. Scott Reef is currently the principal reef in the MoU 74 Box and is utilised seasonally by Indonesian fishers to harvest trepang, trochus shells and other reef species. The peak season is July to October due to more favourable wind conditions, and to allow fishers to sun dry their catch on their boat decks (ERM, 2009). Browse Island is also frequently visited by shark fishers who mostly fish along the eastern margin of the MoU 74 Box.

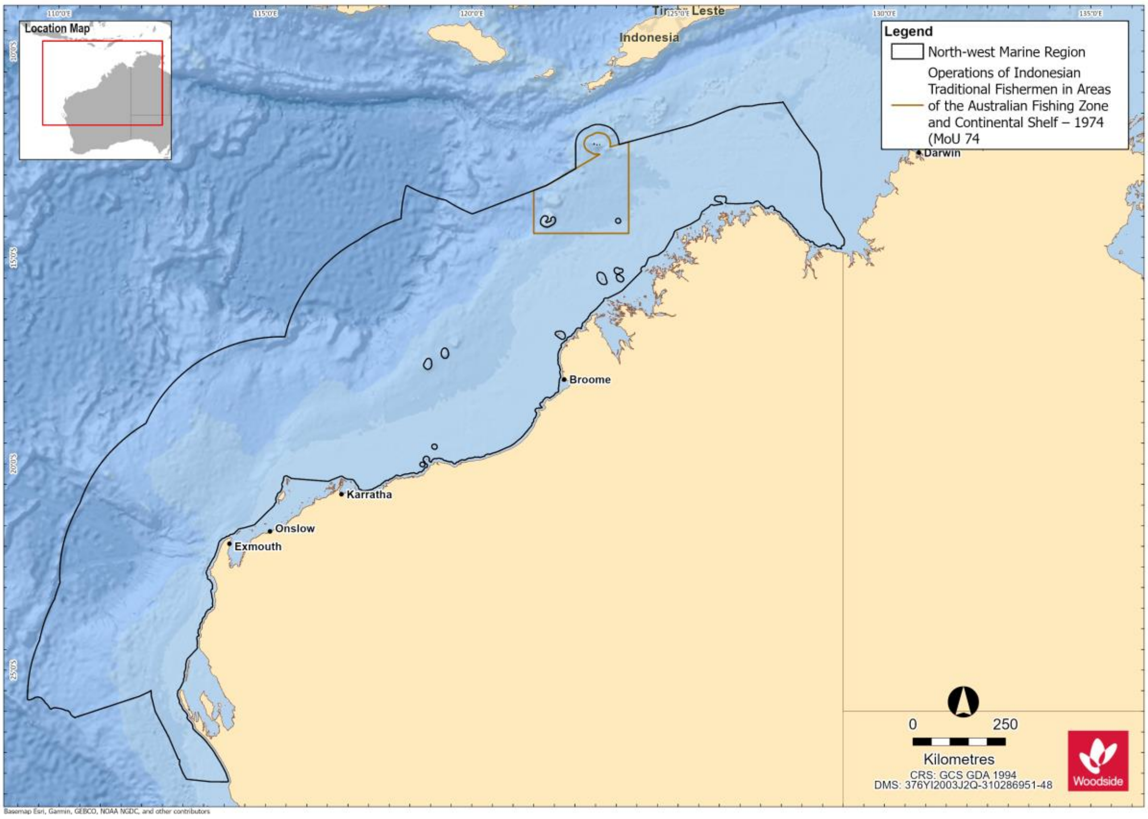

Figure 11-1 MOU 74 Box. Operations of Indonesian Traditional Fishermen in Areas of the Australian Fishing Zone and Continental Shelf – 1974

11.7 Tourism and Recreation

There are growing tourism and recreational sectors in WA. The Kimberley, Pilbara and Gascoyne regions are popular visitor destinations for Australian and international tourists. Tourism is concentrated in the vicinity of population centres including Broome, Dampier, Exmouth, Coral Bay and Shark Bay.

Recreational and tourism activities include: charter fishing, other recreational fishing, diving, snorkelling, marine fauna watching, and yachting.

11.7.1 Gascoyne Region

Outside the petroleum industry, tourism is the largest revenue earner of all the major industries of the Gascoyne region. It contributes significantly to the local economy in terms of both income and employment. In 2018 there was an average of 337,400 visitors with a visitor spend of $359 million (Gascoyne Development Commission[11]).

In 2018-19, the Ningaloo region (Ningaloo Reef and the surrounding coastal region Exmouth Gulf, communities of Exmouth and Coral Bay, and adjacent proposed southern coastal reserves and pastoral leases) contributed an estimated $110 million in value added to the WA economy (DCBA, 2020). Ningaloo's economic contribution to WA is attributed to four key types of economic activity, tourism expenditure by international, interstate and WA visitors to the Ningaloo region, commercial fishing in the Exmouth Gulf, recreation activity involving the Reef by residents of the Ningaloo region and management and research relating to the Reef (DCBA, 2020). More than 90% of this value added is attributed to the domestic and international tourists who visit Ningaloo each year (DCBA, 2020). The main marine nature-based tourist activities are concentrated around and within the Ningaloo WHA.

11.7.2 Pilbara region

Recreation and tourism activities within the Pilbara are of high social value. Tourism is a key economic driver for the Pilbara with more than 1 million visitors to the region every year, generating $413 million in gross revenue annually (Pilbara Development Commission[12]).

Recreational fishing within the Pilbara region tends to be concentrated in State waters adjacent to population centres. Recreational fishing is known to occur around the Dampier Archipelago with boats launched from boat ramps around Dampier and Karratha (Williamson *et al.*, 2006). Once at sea, charter vessels may also frequent the waters surrounding the Montebello Islands.

11.7.3 Kimberley Region

Recreation and tourism activities in the Kimberley region occur predominantly in WA State waters (extending offshore 3 nm from the mainland), adjacent to coastal population centres (e.g. Broome), with a peak in activity during the winter months (dry season). These activities include recreational fishing, diving, snorkelling, wildlife watching and boating.

Primary dive locations in the Kimberley region include the Rowley Shoals, including Mermaid Reef AMP, Scott Reef, Seringapatam Reef, Ashmore Reef AMP and Cartier Island.

11.8 Shipping

Commercial shipping traffic is high within the NWMR with vessel activities including commercial fisheries, tourism such as cruises, international shipping and oil and gas operations. There are 12 ports adjacent to the NWMR, including the major ports of Dampier, Port Hedland and Broome, which are operated by their respective port authorities. These ports handle large tonnages of iron ore and petroleum exports in addition to salt, manganese, feldspar chromite and copper (DEWHA, 2008).

Heavy vessel traffic exists within the Pilbara Port Authority management area which recorded 10,064 vessel movements in Port of Dampier 2019/20 annual reporting period (PPA, 2020). Twenty-six designated anchorages for bulk carriers, petroleum and gas tankers, drilling rigs, offshore platforms, and pipelay vessels are located offshore of Rosemary Island.

In 2012, AMSA established a network of shipping fairways off the northwest coast of Australia. The shipping fairways, while not mandatory, aim to reduce the risk of collision between transiting vessels and offshore infrastructure. The fairways are intended to direct large vessels such as bulk carriers and LNG ships trading to the major ports into pre-defined routes to keep them clear of existing and planned offshore infrastructure (AMSA, 2013).

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[11] https://www.gdc.wa.gov.au/industry-profiles/tourism/

[12] https://www.pdc.wa.gov.au/our-focus/strategicinitiatives/tourism

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11.9 Oil and Gas Infrastructure

The NWMR supports a number of industries including petroleum exploration and production.

Within the NWMR there are seven sedimentary petroleum basins: Northern and Southern Carnarvon basins, Perth, Browse, Roebuck, Offshore Canning and Bonaparte basins. Of these, the Northern Carnarvon, Browse and Bonaparte basins hold large quantities of gas and comprise most of Australia's reserves of natural gas (DEWHA, 2008), which is reflected by the level of development in the area. In addition to existing facilities, there are proposed developments in the region. This includes proposals to develop gas and condensate from a number of fields within the NWMR.

In addition to the oil and gas industry, other land-based industries depend upon the marine environment in the nearshore area. These include ports, salt mines such as Karratha and Onslow, LNG onshore processing facilities such as Burrup Hub, Thevenard Island, Barrow Island, Varanus Island, and small-scale desalination plants at Barrow Island, Burrup, Cape Preston, and Onslow.

11.10 Defence

Key Australian Department of Defence (DoD) operational areas and facilities areas of the NWMR for training and operational activities, include:

- An operating logistics base has been established in Dampier to support vessels patrolling the waters around offshore oil and gas facilities. A dedicated navy administrative support facility is also being constructed at the nearby township of Karratha.
- The Royal Australian Air Force currently maintains two 'bare bases' in remote areas of WA that are used for military exercises. One of these is the Royal Australian Air Force Base in Learmonth. The Royal Australian Air Force maintains the Commonwealth Heritage listed Learmonth Air Weapons Range Facility, which is located between Ningaloo Station and the Cape Range National Park. The air training area associated with the Learmonth base extends over the offshore region.
- The Royal Australian Air Force Base Curtin is located on the north coast of WA, south-east of Derby and 170 km east of Broome. It provides support for land, air and sea operations aimed to support Australia's northern approaches.
- The Naval Communications Station Harold E. Holt is located ~6 km north of Exmouth. The main role of the station is to communicate at very low frequencies (19.8 kHz) with Australian and United States submarines and ships in the eastern Indian Ocean and the western Pacific Ocean.

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APPENDIX A. PROTECTED MATTER SEARCH REPORTS FOR NWMR, SWMR AND NMR

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Australian Government

Department of Agriculture,
Water and the Environment

EPBC Act Protected Matters Report

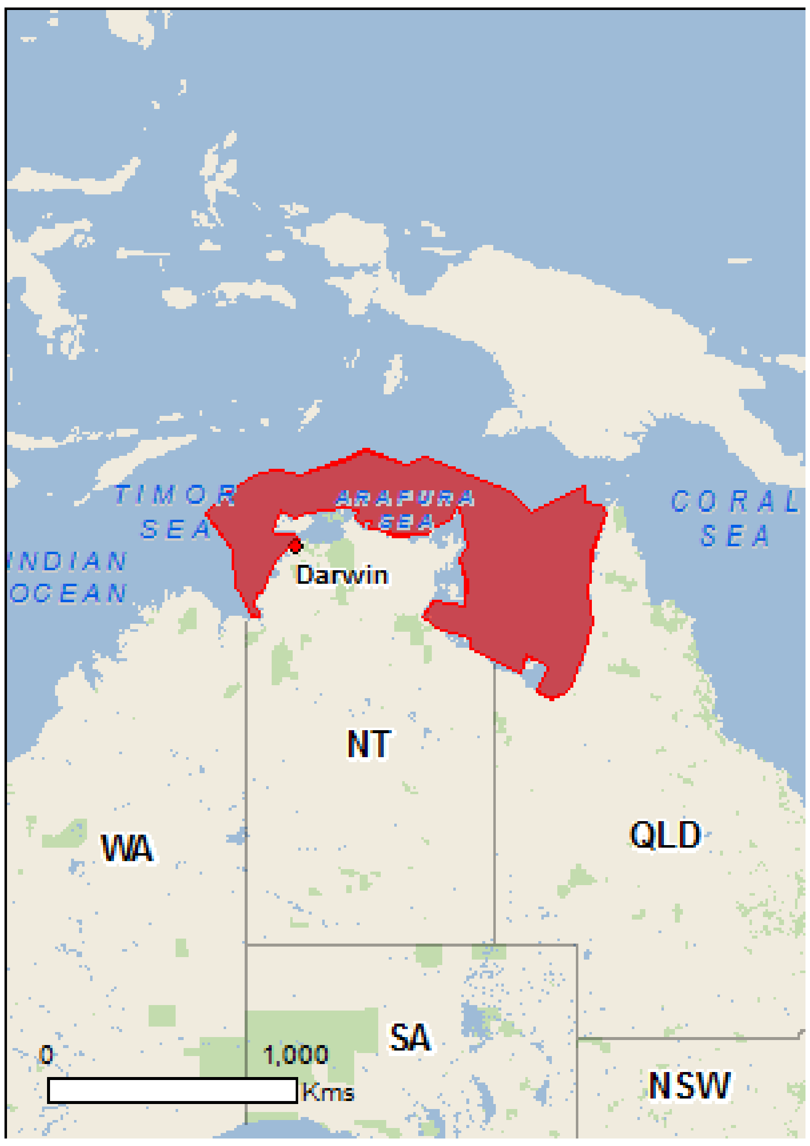
This report provides general guidance on matters of national environmental significance and other matters protected by the EPBC Act in the area you have selected.

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: 10/05/21 12:59:15

- Summary
- Details
  - Matters of NES
  - Other Matters Protected by the EPBC Act
  - Extra Information
- Caveat
- Acknowledgements



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Coordinates

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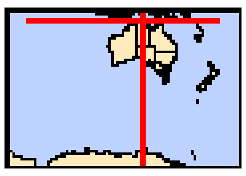

Summary

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:	2
Listed Threatened Ecological Communities:	None
Listed Threatened Species:	33
Listed Migratory Species:	70

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:	127
Whales and Other Cetaceans:	25
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Australian Marine Parks:	15

Extra Information

This part of the report provides information that may also be relevant to the area you have nominated.

State and Territory Reserves:	2
Regional Forest Agreements:	None
Invasive Species:	1
Nationally Important Wetlands:	1
Key Ecological Features (Marine)	8

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
Extended Continental Shelf

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

Listed Threatened Species [Resource Information]

Name	Status	Type of Presence
Birds		
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat known to occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat known to occur within area
Calidris tenuirostris Great Knot [862]	Critically Endangered	Species or species habitat known to occur within area
Charadrius leschenaultii Greater Sand Plover, Large Sand Plover [877]	Vulnerable	Species or species habitat known to occur within area
Charadrius mongolus Lesser Sand Plover, Mongolian Plover [879]	Endangered	Species or species habitat known to occur within area
Erythrotriorchis radiatus Red Goshawk [942]	Vulnerable	Species or species habitat likely to occur within area
Erythrura gouldiae Gouldian Finch [413]	Endangered	Species or species habitat may occur within area
Falcunculus frontatus whitei Crested Shrike-tit (northern), Northern Shrike-tit [26013]	Vulnerable	Species or species habitat likely to occur within area
Limosa lapponica baueri Nunivak Bar-tailed Godwit, Western Alaskan Bar-	Vulnerable	Species or species

Name	Status	Type of Presence
tailed Godwit [86380]		habitat known to occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat known to occur within area
Rostratula australis Australian Painted Snipe [77037]	Endangered	Species or species habitat may occur within area
Mammals		
Balaenoptera borealis Sei Whale [34]	Vulnerable	Species or species habitat likely to occur within area
Balaenoptera musculus Blue Whale [36]	Endangered	Species or species habitat likely to occur within area
Balaenoptera physalus Fin Whale [37]	Vulnerable	Species or species habitat likely to occur within area
Macroderma gigas Ghost Bat [174]	Vulnerable	Species or species habitat likely to occur within area
Megaptera novaeangliae Humpback Whale [38]	Vulnerable	Species or species habitat likely to occur within area
Notomys aquilo Northern Hopping-mouse, Woorrentinta [123]	Endangered	Species or species habitat may occur within area
Saccolaimus saccolaimus nudicluniatus Bare-rumped Sheath-tailed Bat, Bare-rumped Sheathtail Bat [66889]	Vulnerable	Species or species habitat may occur within area
Xeromys myoides Water Mouse, False Water Rat, Yirrkoo [66]	Vulnerable	Species or species habitat may occur within area
Reptiles		
Caretta caretta Loggerhead Turtle [1763]	Endangered	Foraging, feeding or related behaviour known to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Breeding known to occur within area
Cryptoblepharus gurrmul Arafura Snake-eyed Skink [83106]	Endangered	Species or species habitat known to occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Congregation or aggregation known to occur within area
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	Breeding known to occur within area
Lepidochelys olivacea Olive Ridley Turtle, Pacific Ridley Turtle [1767]	Endangered	Breeding known to occur within area
Natator depressus Flatback Turtle [59257]	Vulnerable	Breeding known to occur within area
Sharks		
Carcharodon carcharias White Shark, Great White Shark [64470]	Vulnerable	Species or species habitat may occur within area

Name	Status	Type of Presence
Glyphis garricki Northern River Shark, New Guinea River Shark [82454]	Endangered	Species or species habitat known to occur within area
Glyphis glyphis Speartooth Shark [82453]	Critically Endangered	Species or species habitat may occur within area
Pristis clavata Dwarf Sawfish, Queensland Sawfish [68447]	Vulnerable	Species or species habitat known to occur within area
Pristis pristis Freshwater Sawfish, Largetooth Sawfish, River Sawfish, Leichhardt's Sawfish, Northern Sawfish [60756]	Vulnerable	Species or species habitat 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	Species or species habitat may 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]		Foraging, feeding or related behaviour known to occur within area
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Calonectris leucomelas Streaked Shearwater [1077]		Species or species habitat known to occur within area
Fregata ariel Lesser Frigatebird, Least Frigatebird [1012]		Species or species habitat known to occur within area
Fregata minor Great Frigatebird, Greater Frigatebird [1013]		Species or species habitat known to occur within area
Sterna dougallii Roseate Tern [817]		Breeding known to occur within area
Sternula albifrons Little Tern [82849]		Species or species habitat may occur within area
Sula leucogaster Brown Booby [1022]		Breeding known to occur within area
Migratory Marine Species		
Anoxypristis cuspidata Narrow Sawfish, Knifetooth Sawfish [68448]		Species or species habitat known to occur within area
Balaenoptera borealis Sei Whale [34]	Vulnerable	Species or species habitat likely to occur within area
Balaenoptera edeni Bryde's Whale [35]		Species or species habitat may occur within area

Name	Threatened	Type of Presence
Balaenoptera musculus Blue Whale [36]	Endangered	Species or species habitat likely to occur within area
Balaenoptera physalus Fin Whale [37]	Vulnerable	Species or species habitat likely to occur within area
Carcharhinus longimanus Oceanic Whitetip Shark [84108]		Species or species habitat may occur within area
Carcharodon carcharias White Shark, Great White Shark [64470]	Vulnerable	Species or species habitat may occur within area
Caretta caretta Loggerhead Turtle [1763]	Endangered	Foraging, feeding or related behaviour known to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Breeding known to occur within area
Crocodylus porosus Salt-water Crocodile, Estuarine Crocodile [1774]		Species or species habitat likely to occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Congregation or aggregation known to occur within area
Dugong dugon Dugong [28]		Species or species habitat known to occur within area
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	Breeding known to occur within area
Isurus oxyrinchus Shortfin Mako, Mako Shark [79073]		Species or species habitat likely to occur within area
Isurus paucus Longfin Mako [82947]		Species or species habitat likely to occur within area
Lepidochelys olivacea Olive Ridley Turtle, Pacific Ridley Turtle [1767]	Endangered	Breeding known to occur within area
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
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 likely to occur within area
Natator depressus Flatback Turtle [59257]	Vulnerable	Breeding known to occur within area
Orcaella heinsohni Australian Snubfin Dolphin [81322]		Species or species habitat known to occur within area
Orcinus orca Killer Whale, Orca [46]		Species or species habitat may occur within area

Name	Threatened	Type of Presence
Physeter macrocephalus Sperm Whale [59]		Species or species habitat may occur within area
Pristis clavata Dwarf Sawfish, Queensland Sawfish [68447]	Vulnerable	Species or species habitat known to occur within area
Pristis pristis Freshwater Sawfish, Largetooth Sawfish, River Sawfish, Leichhardt's Sawfish, Northern Sawfish [60756]	Vulnerable	Species or species habitat 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	Species or species habitat may occur within area
Sousa chinensis Indo-Pacific Humpback Dolphin [50]		Breeding known to occur within area
Tursiops aduncus (Arafura/Timor Sea populations) Spotted Bottlenose Dolphin (Arafura/Timor Sea populations) [78900]		Species or species habitat known to occur within area
Migratory Terrestrial Species		
Cecropis daurica Red-rumped Swallow [80610]		Species or species habitat may occur within area
Cuculus optatus Oriental Cuckoo, Horsfield's Cuckoo [86651]		Species or species habitat may occur within area
Hirundo rustica Barn Swallow [662]		Species or species habitat may occur within area
Motacilla cinerea Grey Wagtail [642]		Species or species habitat may occur within area
Motacilla flava Yellow Wagtail [644]		Species or species habitat may occur within area
Migratory Wetlands Species		
Acrocephalus orientalis Oriental Reed-Warbler [59570]		Species or species habitat may occur within area
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat known to occur within area
Arenaria interpres Ruddy Turnstone [872]		Species or species habitat known to occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat known to occur within area
Calidris alba Sanderling [875]		Species or species habitat likely to occur within area
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat known to occur within area

Name	Threatened	Type of Presence
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat known to occur within area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat may occur within area
Calidris ruficollis Red-necked Stint [860]		Species or species habitat known to occur within area
Calidris tenuirostris Great Knot [862]	Critically Endangered	Species or species habitat known to occur within area
Charadrius leschenaultii Greater Sand Plover, Large Sand Plover [877]	Vulnerable	Species or species habitat known to occur within area
Charadrius mongolus Lesser Sand Plover, Mongolian Plover [879]	Endangered	Species or species habitat known to occur within area
Charadrius veredus Oriental Plover, Oriental Dotterel [882]		Species or species habitat may occur within area
Glareola maldivarum Oriental Pratincole [840]		Species or species habitat may occur within area
Limicola falcinellus Broad-billed Sandpiper [842]		Species or species habitat likely to occur within area
Limosa lapponica Bar-tailed Godwit [844]		Species or species habitat known to occur within area
Limosa limosa Black-tailed Godwit [845]		Species or species habitat known to occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat known to occur within area
Numenius minutus Little Curlew, Little Whimbrel [848]		Species or species habitat known to occur within area
Numenius phaeopus Whimbrel [849]		Species or species habitat known to occur within area
Pandion haliaetus Osprey [952]		Species or species habitat known to occur within area
Pluvialis fulva Pacific Golden Plover [25545]		Species or species habitat known to occur within area
Pluvialis squatarola Grey Plover [865]		Species or species habitat known to occur within area
Thalasseus bergii Greater Crested Tern [83000]		Breeding likely to occur within area
Tringa brevipes Grey-tailed Tattler [851]		Species or species

Name	Threatened	Type of Presence
		habitat known to occur within area
Tringa nebularia Common Greenshank, Greenshank [832]		Species or species habitat known to occur within area
Tringa stagnatilis Marsh Sandpiper, Little Greenshank [833]		Species or species habitat known to occur within area
Xenus cinereus Terek Sandpiper [59300]		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		
Acrocephalus orientalis Oriental Reed-Warbler [59570]		Species or species habitat may occur within area
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat known to occur within area
Anous stolidus Common Noddy [825]		Foraging, feeding or related behaviour known to occur within area
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Arenaria interpres Ruddy Turnstone [872]		Species or species habitat known to occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat known to occur within area
Calidris alba Sanderling [875]		Species or species habitat likely to occur within area
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat known to occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat known to occur within area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat may occur within area

Name	Threatened	Type of Presence
Calidris ruficollis Red-necked Stint [860]		Species or species habitat known to occur within area
Calidris tenuirostris Great Knot [862]	Critically Endangered	Species or species habitat known to occur within area
Calonectris leucomelas Streaked Shearwater [1077]		Species or species habitat known to occur within area
Charadrius leschenaultii Greater Sand Plover, Large Sand Plover [877]	Vulnerable	Species or species habitat known to occur within area
Charadrius mongolus Lesser Sand Plover, Mongolian Plover [879]	Endangered	Species or species habitat known to occur within area
Charadrius ruficapillus Red-capped Plover [881]		Species or species habitat known to occur within area
Charadrius veredus Oriental Plover, Oriental Dotterel [882]		Species or species habitat may occur within area
Fregata ariel Lesser Frigatebird, Least Frigatebird [1012]		Species or species habitat known to occur within area
Fregata minor Great Frigatebird, Greater Frigatebird [1013]		Species or species habitat known to occur within area
Glareola maldivarum Oriental Pratincole [840]		Species or species habitat may occur within area
Haliaeetus leucogaster White-bellied Sea-Eagle [943]		Species or species habitat likely to occur within area
Heteroscelus brevipes Grey-tailed Tattler [59311]		Species or species habitat known to occur within area
Himantopus himantopus Pied Stilt, Black-winged Stilt [870]		Species or species habitat known to occur within area
Hirundo daurica Red-rumped Swallow [59480]		Species or species habitat may occur within area
Hirundo rustica Barn Swallow [662]		Species or species habitat may occur within area
Limicola falcinellus Broad-billed Sandpiper [842]		Species or species habitat likely to occur within area
Limosa lapponica Bar-tailed Godwit [844]		Species or species habitat known to occur within area
Limosa limosa Black-tailed Godwit [845]		Species or species habitat known to occur within area

Name	Threatened	Type of Presence
Motacilla cinerea Grey Wagtail [642]		Species or species habitat may occur within area
Motacilla flava Yellow Wagtail [644]		Species or species habitat may occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat known to occur within area
Numenius minutus Little Curlew, Little Whimbrel [848]		Species or species habitat known to occur within area
Numenius phaeopus Whimbrel [849]		Species or species habitat known to occur within area
Pandion haliaetus Osprey [952]		Species or species habitat known to occur within area
Pluvialis fulva Pacific Golden Plover [25545]		Species or species habitat known to occur within area
Pluvialis squatarola Grey Plover [865]		Species or species habitat known to occur within area
Recurvirostra novaehollandiae Red-necked Avocet [871]		Species or species habitat known to occur within area
Rostratula benghalensis (sensu lato) Painted Snipe [889]	Endangered*	Species or species habitat may occur within area
Sterna albifrons Little Tern [813]		Species or species habitat may occur within area
Sterna bengalensis Lesser Crested Tern [815]		Breeding known to occur within area
Sterna bergii Crested Tern [816]		Breeding likely to occur within area
Sterna dougallii Roseate Tern [817]		Breeding known to occur within area
Stiltia isabella Australian Pratincole [818]		Species or species habitat known to occur within area
Sula leucogaster Brown Booby [1022]		Breeding known to occur within area
Tringa nebularia Common Greenshank, Greenshank [832]		Species or species habitat known to occur within area
Tringa stagnatilis Marsh Sandpiper, Little Greenshank [833]		Species or species habitat known to occur within area
Xenus cinereus Terek Sandpiper [59300]		Species or species habitat known to occur within area
Fish		

Name	Threatened	Type of Presence
Acentronura tentaculata Shortpouch Pygmy Pipehorse [66187]		Species or species habitat may occur within area
Bhanotia fasciolata Corrugated Pipefish, Barbed Pipefish [66188]		Species or species habitat may occur within area
Campichthys tricarinatus Three-keel Pipefish [66192]		Species or species habitat may occur within area
Choeroichthys brachysoma Pacific Short-bodied Pipefish, Short-bodied Pipefish [66194]		Species or species habitat may occur within area
Choeroichthys suillus Pig-snouted Pipefish [66198]		Species or species habitat may occur within area
Corythoichthys amplexus Fijian Banded Pipefish, Brown-banded Pipefish [66199]		Species or species habitat may occur within area
Corythoichthys flavofasciatus Reticulate Pipefish, Yellow-banded Pipefish, Network Pipefish [66200]		Species or species habitat may occur within area
Corythoichthys haematopterus Reef-top Pipefish [66201]		Species or species habitat may occur within area
Corythoichthys intestinalis Australian Messmate Pipefish, Banded Pipefish [66202]		Species or species habitat may occur within area
Corythoichthys ocellatus Orange-spotted Pipefish, Ocellated Pipefish [66203]		Species or species habitat may occur within area
Corythoichthys schultzi Schultz's Pipefish [66205]		Species or species habitat may occur within area
Cosmocampus banneri Roughridge Pipefish [66206]		Species or species habitat may occur within area
Cosmocampus maxweberi Maxweber's Pipefish [66209]		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
Festucalex cinctus Girdled Pipefish [66214]		Species or species habitat may occur within area
Filicampus tigris Tiger Pipefish [66217]		Species or species habitat may occur within area

Name	Threatened	Type of Presence
Halicampus brocki Brock's Pipefish [66219]		Species or species habitat may occur within area
Halicampus dunckeri Red-hair Pipefish, Duncker's Pipefish [66220]		Species or species habitat may occur within area
Halicampus grayi Mud Pipefish, Gray's Pipefish [66221]		Species or species habitat may occur within area
Halicampus macrorhynchus Whiskered Pipefish, Ornate Pipefish [66222]		Species or species habitat may occur within area
Halicampus spinirostris Spiny-snout Pipefish [66225]		Species or species habitat may occur within area
Haliichthys taeniophorus Ribboned Pipehorse, Ribboned Seadragon [66226]		Species or species habitat may occur within area
Hippichthys cyanospilos Blue-speckled Pipefish, Blue-spotted Pipefish [66228]		Species or species habitat may occur within area
Hippichthys heptagonus Madura Pipefish, Reticulated Freshwater Pipefish [66229]		Species or species habitat may occur within area
Hippichthys parvicarinatus Short-keel Pipefish, Short-keeled Pipefish [66230]		Species or species habitat may occur within area
Hippichthys penicillus Beady Pipefish, Steep-nosed Pipefish [66231]		Species or species habitat may occur within area
Hippichthys spicifer Belly-barred Pipefish, Banded Freshwater Pipefish [66232]		Species or species habitat may occur within area
Hippocampus angustus Western Spiny Seahorse, Narrow-bellied Seahorse [66234]		Species or species habitat may occur within area
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
Hippocampus zebra Zebra Seahorse [66241]		Species or species habitat may occur within area

Name	Threatened	Type of Presence
Micrognathus brevirostris thorntail Pipefish, Thorn-tailed Pipefish [66254]		Species or species habitat may occur within area
Micrognathus micronotopterus Tidepool Pipefish [66255]		Species or species habitat may occur within area
Microphis brachyurus Short-tail Pipefish, Short-tailed River Pipefish [66257]		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
Mammals		
Dugong dugon Dugong [28]		Species or species habitat known to 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
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	Foraging, feeding or related behaviour known to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Breeding known to occur within area
Crocodylus porosus Salt-water Crocodile, Estuarine Crocodile [1774]		Species or species habitat likely to occur within area

Name	Threatened	Type of Presence
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Congregation or aggregation 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
Enhydrina schistosa Beaked Seasnake [1126]		Species or species habitat may occur within area
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	Breeding known to occur within area
Hydrelaps darwiniensis Black-ringed Seasnake [1100]		Species or species habitat may occur within area
Hydrophis atriceps Black-headed Seasnake [1101]		Species or species habitat may occur within area
Hydrophis caerulescens Dwarf Seasnake [1103]		Species or species habitat may occur within area
Hydrophis coggeri Slender-necked Seasnake [25925]		Species or species habitat may 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 gracilis Slender Seasnake [1106]		Species or species habitat may occur within area
Hydrophis inornatus Plain Seasnake [1107]		Species or species habitat may occur within area
Hydrophis mcdowelli null [25926]		Species or species habitat may occur within area
Hydrophis melanosoma Black-banded Robust Seasnake [1109]		Species or species habitat may occur within area
Hydrophis ornatus Spotted Seasnake, Ornate Reef Seasnake [1111]		Species or species habitat may occur within area
Hydrophis pacificus Large-headed Seasnake, Pacific Seasnake [1112]		Species or species habitat may occur within area
Hydrophis vorisi a seasnake [25927]		Species or species

Name	Threatened	Type of Presence
		habitat may occur within area
Lapemis hardwickii Spine-bellied Seasnake [1113]		Species or species habitat may occur within area
Laticauda colubrina a sea krait [1092]		Species or species habitat may occur within area
Laticauda laticaudata a sea krait [1093]		Species or species habitat may occur within area
Lepidochelys olivacea Olive Ridley Turtle, Pacific Ridley Turtle [1767]	Endangered	Breeding known to occur within area
Natator depressus Flatback Turtle [59257]	Vulnerable	Breeding known to occur within area
Parahydrophis mertoni Northern Mangrove Seasnake [1090]		Species or species habitat may 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 borealis Sei Whale [34]	Vulnerable	Species or species habitat likely to occur within area
Balaenoptera edeni Bryde's Whale [35]		Species or species habitat may occur within area
Balaenoptera musculus Blue Whale [36]	Endangered	Species or species habitat likely to occur within area
Balaenoptera physalus Fin Whale [37]	Vulnerable	Species or species habitat likely to occur within area
Delphinus delphis Common 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

Name	Status	Type of Presence
Megaptera novaeangliae Humpback Whale [38]	Vulnerable	Species or species habitat likely to occur within area
Orcaella brevirostris Irrawaddy Dolphin [45]		Species or species habitat known to occur within area
Orcinus orca Killer Whale, Orca [46]		Species or species habitat may occur within area
Peponocephala electra Melon-headed Whale [47]		Species or species habitat may occur within area
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]		Breeding known to occur within area
Stenella attenuata Spotted Dolphin, Pantropical Spotted Dolphin [51]		Species or species habitat may occur within area
Stenella coeruleoalba Striped Dolphin, Euphrosyne Dolphin [52]		Species or species habitat may occur within area
Stenella longirostris Long-snouted Spinner Dolphin [29]		Species or species habitat may occur within area
Steno bredanensis Rough-toothed Dolphin [30]		Species or species habitat may occur within area
Tursiops aduncus Indian Ocean Bottlenose Dolphin, Spotted Bottlenose Dolphin [68418]		Species or species habitat likely to occur within area
Tursiops aduncus (Arafura/Timor Sea populations) Spotted Bottlenose Dolphin (Arafura/Timor Sea populations) [78900]		Species or species habitat known to occur within area
Tursiops truncatus s. str. Bottlenose Dolphin [68417]		Species or species habitat may occur within area
Ziphius cavirostris Cuvier's Beaked Whale, Goose-beaked Whale [56]		Species or species habitat may occur within area

Australian Marine Parks [Resource Information]

Name	Label
Arafura	Multiple Use Zone (IUCN VI)
Arafura	Special Purpose Zone (Trawl) (IUCN VI)
Arnhem	Special Purpose Zone (IUCN VI)
Gulf of Carpentaria	National Park Zone (IUCN II)
Gulf of Carpentaria	Special Purpose Zone (Trawl) (IUCN VI)
Joseph Bonaparte Gulf	Multiple Use Zone (IUCN VI)

Name	Label
Joseph Bonaparte Gulf	Special Purpose Zone (IUCN VI)
Limmen	Habitat Protection Zone (IUCN IV)
Oceanic Shoals	Multiple Use Zone (IUCN VI)
Oceanic Shoals	Special Purpose Zone (Trawl) (IUCN VI)
Wessel	Habitat Protection Zone (IUCN IV)
Wessel	Special Purpose Zone (Trawl) (IUCN VI)
West Cape York	Habitat Protection Zone (IUCN IV)
West Cape York	National Park Zone (IUCN II)
West Cape York	Special Purpose Zone (IUCN VI)

Extra Information

State and Territory Reserves [Resource Information]

Name	State
Anindilyakwa	NT
Marthakal	NT

Invasive Species [Resource Information]

Weeds reported here are the 20 species of national significance (WoNS), along with other introduced plants that are considered by the States and Territories to pose a particularly significant threat to biodiversity. The following feral animals are reported: Goat, Red Fox, Cat, Rabbit, Pig, Water Buffalo and Cane Toad. Maps from Landscape Health Project, National Land and Water Resouces Audit, 2001.

Name	Status	Type of Presence
Plants		
Andropogon gayanus Gamba Grass [66895]		Species or species habitat likely to occur within area

Nationally Important Wetlands [Resource Information]

Name	State
Southern Gulf Aggregation	QLD

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
Carbonate bank and terrace system of the Van	North
Gulf of Carpentaria basin	North
Gulf of Carpentaria coastal zone	North
Pinnacles of the Bonaparte Basin	North
Plateaux and saddle north-west of the Wellesley	North
Shelf break and slope of the Arafura Shelf	North
Submerged coral reefs of the Gulf of Carpentaria	North
Tributary Canyons of the Arafura Depression	North

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

-14.758882 129.178077,-13.960657 128.826514,-13.768665 128.606788,-12.484784 128.496924,-11.183724 127.563087,-10.460737 128.233253,-9.746889 129.518653,-9.660256 130.254737,-9.779371 130.935889,-9.280976 132.528907,-8.901286 133.385841,-9.411062 134.858008,-9.129149 135.473243,-10.363488 138.582374,-11.129831 139.395362,-10.190527 141.339942,-10.806262 141.317969,-10.817053 141.922217,-11.10827 142.087012,-12.527687 141.559669,-13.330764 141.515723,-13.960657 141.40586,-15.045535 141.570655,-15.945419 141.317969,-17.22994 140.823585,-17.513041 140.53794,-17.659661 140.032569,-17.429205 139.593116,-16.630864 139.966651,-16.409675 139.812842,-16.177683 139.208594,-16.820251 138.966895,-15.924291 137.165137,-15.575354 137.132178,-15.458909 136.934424,-15.289418 136.11045,-14.822615 135.45127,-14.269641 135.846778,-14.418655 136.97837,-13.608551 137.011329,-12.784952 136.780616,-12.388227 137.055274,-10.957305 136.76963,-10.957305 136.703712,-11.399198 136.407081,-11.679068 135.824805,-11.904912 135.616065,-11.947909 134.473487,-11.679068 133.869239,-11.700585 133.50669,-11.431505 133.528663,-11.442273 133.363868,-11.64679 133.254005,-11.313028 132.979346,-11.04358 133.067237,-10.90337 132.583839,-11.151389 131.221534,-11.3238 130.782081,-11.054363 130.287696,-11.474575 130.111915,-11.765126 129.958106,-11.947909 130.067969,-11.894162 130.760108,-12.119827 130.913917,-12.441874 130.474464,-12.870649 130.100928,-13.939333 129.584571,-13.971319 129.419776,-14.47185 129.28794,-14.631358 129.507667,-14.843856 129.452735,-14.769505 129.178077,-14.758882 129.178077

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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Department of Agriculture,
Water and the Environment

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.

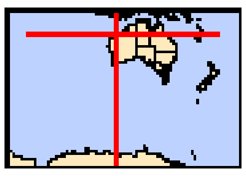
Information is available about Environment Assessments and the EPBC Act including significance guidelines, forms and application process details.

Report created: 10/05/21 13:07:00

- Summary
- Details
  - Matters of NES
  - Other Matters Protected by the EPBC Act
  - Extra Information
- Caveat
- Acknowledgements

This map may contain data which are ©Commonwealth of Australia (Geoscience Australia), ©PSMA 2015

Coordinates
Buffer: 1.0Km



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:	2
National Heritage Places:	5
Wetlands of International Importance:	2
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	2
Listed Threatened Ecological Communities:	1
Listed Threatened Species:	70
Listed Migratory Species:	84

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:	1
Listed Marine Species:	149
Whales and Other Cetaceans:	34
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Australian Marine Parks:	17

Extra Information

This part of the report provides information that may also be relevant to the area you have nominated.

State and Territory Reserves:	10
Regional Forest Agreements:	None
Invasive Species:	23
Nationally Important Wetlands:	3
Key Ecological Features (Marine)	5

Details

Matters of National Environmental Significance

World Heritage Properties [Resource Information]

Name	State	Status
Shark Bay, Western Australia	WA	Declared property
The Ningaloo Coast	WA	Declared property

National Heritage Properties [Resource Information]

Name	State	Status
Natural		
Shark Bay, Western Australia	WA	Listed place
The Ningaloo Coast	WA	Listed place
The West Kimberley	WA	Listed place
Indigenous		
Dampier Archipelago (including Burrup Peninsula)	WA	Listed place
Historic		
Dirk Hartog Landing Site 1616 - Cape Inscription Area	WA	Listed place

Wetlands of International Importance (Ramsar) [Resource Information]

Name	Proximity
Eighty-mile beach	Within Ramsar site
Ord river floodplain	Within 10km of Ramsar

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
Extended Continental Shelf

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 Ecological Communities [Resource Information]

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.

Name	Status	Type of Presence
Monsoon vine thickets on the coastal sand dunes of Dampier Peninsula	Endangered	Community likely to occur within area

Listed Threatened Species [Resource Information]

Name	Status	Type of Presence
Birds		
Anous tenuirostris melanops		
Australian Lesser Noddy [26000]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Calidris canutus		
Red Knot, Knot [855]	Endangered	Species or species habitat known to occur within area
Calidris ferruginea		
Curlew Sandpiper [856]	Critically Endangered	Species or species

Name	Status	Type of Presence
		habitat known to occur within area
Calidris tenuirostris Great Knot [862]	Critically Endangered	Species or species habitat known to occur within area
Charadrius leschenaultii Greater Sand Plover, Large Sand Plover [877]	Vulnerable	Species or species habitat known to occur within area
Diomedea amsterdamensis Amsterdam Albatross [64405]	Endangered	Species or species habitat likely to occur within area
Diomedea exulans Wandering Albatross [89223]	Vulnerable	Species or species habitat may occur within area
Erythrotriorchis radiatus Red Goshawk [942]	Vulnerable	Species or species habitat likely to occur within area
Erythrura gouldiae Gouldian Finch [413]	Endangered	Species or species habitat known to occur within area
Falco hypoleucos Grey Falcon [929]	Vulnerable	Species or species habitat known to occur within area
Falcunculus frontatus whitei Crested Shrike-tit (northern), Northern Shrike-tit [26013]	Vulnerable	Species or species habitat likely to occur within area
Geophaps smithii blaauwi Partridge Pigeon (western) [66501]	Vulnerable	Species or species habitat likely to occur within area
Leipoa ocellata Malleefowl [934]	Vulnerable	Species or species habitat likely to occur within area
Limosa lapponica baueri Nunivak Bar-tailed Godwit, Western Alaskan Bar-tailed Godwit [86380]	Vulnerable	Species or species habitat may occur within area
Limosa lapponica menzbieri Northern Siberian Bar-tailed Godwit, Russkoye Bar-tailed Godwit [86432]	Critically Endangered	Species or species habitat known to occur within area
Macronectes giganteus Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Species or species habitat may occur within area
Macronectes halli Northern Giant Petrel [1061]	Vulnerable	Species or species habitat may occur within area
Malurus leucopterus leucopterus White-winged Fairy-wren (Dirk Hartog Island), Dirk Hartog Black-and-White Fairy-wren [26004]	Vulnerable	Species or species habitat likely to occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat known to occur within area
Papasula abbotti Abbott's Booby [59297]	Endangered	Species or species habitat may occur within area
Pezoporus occidentalis Night Parrot [59350]	Endangered	Species or species habitat may occur within

Name	Status	Type of Presence
		area
Pterodroma mollis Soft-plumaged Petrel [1036]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Rostratula australis Australian Painted Snipe [77037]	Endangered	Species or species habitat likely to occur within area
Sternula nereis nereis Australian Fairy Tern [82950]	Vulnerable	Breeding known to occur within area
Thalassarche carteri Indian Yellow-nosed Albatross [64464]	Vulnerable	Foraging, feeding or related behaviour may occur within area
Thalassarche cauta Shy Albatross [89224]	Endangered	Species or species habitat may occur within area
Thalassarche impavida Campbell Albatross, Campbell Black-browed Albatross [64459]	Vulnerable	Species or species habitat may occur within area
Thalassarche melanophris Black-browed Albatross [66472]	Vulnerable	Species or species habitat may occur within area
Thalassarche steadi White-capped Albatross [64462]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Tyto novaehollandiae kimberli Masked Owl (northern) [26048]	Vulnerable	Species or species habitat 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 to occur within area
Bettongia lesueur lesueur Burrowing Bettong (Shark Bay), Boodie [66659]	Vulnerable	Species or species habitat likely to occur within area
Bettongia penicillata ogilbyi Woylie [66844]	Endangered	Species or species habitat likely to occur within area
Conilurus penicillatus Brush-tailed Rabbit-rat, Brush-tailed Tree-rat, Pakooma [132]	Vulnerable	Species or species habitat may occur within area
Dasyurus geoffroii Chuditch, Western Quoll [330]	Vulnerable	Species or species habitat may occur within area
Dasyurus hallucatus Northern Quoll, Digul [Gogo-Yimidir], Wijingadda [Dambimangari], Wiminji [Martu] [331]	Endangered	Species or species habitat known to occur within area
Eubalaena australis Southern Right Whale [40]	Endangered	Species or species habitat likely to occur within area

Name	Status	Type of Presence
Isoodon auratus auratus Golden Bandicoot (mainland) [66665]	Vulnerable	Species or species habitat likely to occur within area
Lagostrophus fasciatus fasciatus Banded Hare-wallaby, Merrnine, Marnine, Munning [66664]	Vulnerable	Translocated population known to occur within area
Leporillus conditor Wopilkara, Greater Stick-nest Rat [137]	Vulnerable	Translocated population known to occur within area
Macroderma gigas Ghost Bat [174]	Vulnerable	Species or species habitat known to occur within area
Macrotis lagotis Greater Bilby [282]	Vulnerable	Species or species habitat likely to occur within area
Megaptera novaeangliae Humpback Whale [38]	Vulnerable	Breeding known to occur within area
Neophoca cinerea Australian Sea-lion, Australian Sea Lion [22]	Endangered	Species or species habitat may occur within area
Perameles bougainville bougainville Western Barred Bandicoot (Shark Bay) [66631]	Endangered	Translocated population known to occur within area
Petrogale concinna monastria Nabarlek (Kimberley) [87607]	Endangered	Species or species habitat known to occur within area
Phascogale tapoatafa kimberleyensis Kimberley brush-tailed phascogale, Brush-tailed Phascogale (Kimberley) [88453]	Vulnerable	Species or species habitat likely to occur within area
Rhinonicteris aurantia (Pilbara form) Pilbara Leaf-nosed Bat [82790]	Vulnerable	Species or species habitat may occur within area
Saccolaimus saccolaimus nudicluniatus Bare-rumped Sheath-tailed Bat, Bare-rumped Sheathtail Bat [66889]	Vulnerable	Species or species habitat likely to occur within area
Xeromys myoides Water Mouse, False Water Rat, Yirrkoo [66]	Vulnerable	Species or species habitat may occur within area
Reptiles		
Aipysurus apraefrontalis Short-nosed Seasnake [1115]	Critically Endangered	Species or species habitat known to occur within area
Aipysurus foliosquama Leaf-scaled Seasnake [1118]	Critically Endangered	Species or species habitat likely to occur within area
Caretta caretta Loggerhead Turtle [1763]	Endangered	Breeding known to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Breeding known to occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Foraging, feeding or related behaviour known to occur within area
Egernia stokesii badia Western Spiny-tailed Skink, Baudin Island Spiny-tailed Skink [64483]	Endangered	Species or species habitat likely to occur

Name	Status	Type of Presence
		within area
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	Breeding known to occur within area
Lepidochelys olivacea Olive Ridley Turtle, Pacific Ridley Turtle [1767]	Endangered	Foraging, feeding or related behaviour known to occur within area
Lerista nevinae Nevin's Slider [85296]	Endangered	Species or species habitat known to occur within area
Liasis olivaceus barroni Olive Python (Pilbara subspecies) [66699]	Vulnerable	Species or species habitat likely to occur within area
Natator depressus Flatback Turtle [59257]	Vulnerable	Breeding 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 known to occur within area
Glyphis garricki Northern River Shark, New Guinea River Shark [82454]	Endangered	Species or species habitat known to occur within area
Pristis clavata Dwarf Sawfish, Queensland Sawfish [68447]	Vulnerable	Breeding known to occur within area
Pristis pristis Freshwater Sawfish, Largetooth Sawfish, River Sawfish, Leichhardt's Sawfish, Northern Sawfish [60756]	Vulnerable	Species or species habitat known to occur within area
Pristis zijsron Green Sawfish, Dindagubba, Narrowsnout Sawfish [68442]	Vulnerable	Breeding 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 likely to occur within area
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Ardenna carneipes Flesh-footed Shearwater, Fleshy-footed Shearwater [82404]		Species or species habitat likely to occur within area
Ardenna pacifica Wedge-tailed Shearwater [84292]		Breeding known to occur within area
Calonectris leucomelas Streaked Shearwater [1077]		Species or species habitat known to occur within area
Diomedea amsterdamensis Amsterdam Albatross [64405]	Endangered	Species or species

Name	Threatened	Type of Presence
		habitat likely to occur within area
Diomedea exulans Wandering Albatross [89223]	Vulnerable	Species or species habitat may occur within area
Fregata ariel Lesser Frigatebird, Least Frigatebird [1012]		Species or species habitat known to occur within area
Fregata minor Great Frigatebird, Greater Frigatebird [1013]		Species or species habitat likely to occur within area
Hydroprogne caspia Caspian Tern [808]		Breeding known to occur within area
Macronectes giganteus Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Species or species habitat may occur within area
Macronectes halli Northern Giant Petrel [1061]	Vulnerable	Species or species habitat may occur within area
Onychoprion anaethetus Bridled Tern [82845]		Breeding known to occur within area
Phaethon lepturus White-tailed Tropicbird [1014]		Foraging, feeding or related behaviour likely to occur within area
Sterna dougallii Roseate Tern [817]		Breeding likely to occur within area
Sternula albifrons Little Tern [82849]		Breeding known to occur within area
Sula leucogaster Brown Booby [1022]		Breeding known to occur within area
Sula sula Red-footed Booby [1023]		Breeding known to occur within area
Thalassarche carteri Indian Yellow-nosed Albatross [64464]	Vulnerable	Foraging, feeding or related behaviour may occur within area
Thalassarche cauta Shy Albatross [89224]	Endangered	Species or species habitat may occur within area
Thalassarche impavida Campbell Albatross, Campbell Black-browed Albatross [64459]	Vulnerable	Species or species habitat may occur within area
Thalassarche melanophris Black-browed Albatross [66472]	Vulnerable	Species or species habitat may occur within area
Thalassarche steadi White-capped Albatross [64462]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Migratory Marine Species		
Anoxypristis cuspidata Narrow Sawfish, Knifetooth Sawfish [68448]		Species or species habitat likely to occur within area
Balaena glacialis australis Southern Right Whale [75529]	Endangered*	Species or species habitat likely to occur within area

Name	Threatened	Type of Presence
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
Carcharhinus longimanus Oceanic Whitetip Shark [84108]		Species or species habitat likely to occur within area
Carcharodon carcharias White Shark, Great White Shark [64470]	Vulnerable	Species or species habitat known to occur within area
Caretta caretta Loggerhead Turtle [1763]	Endangered	Breeding known to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Breeding known to occur within area
Crocodylus porosus Salt-water Crocodile, Estuarine Crocodile [1774]		Species or species habitat likely to occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Foraging, feeding or related behaviour known to occur within area
Dugong dugon Dugong [28]		Breeding known to occur within area
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	Breeding known to occur within area
Isurus oxyrinchus Shortfin Mako, Mako Shark [79073]		Species or species habitat likely to occur within area
Isurus paucus Longfin Mako [82947]		Species or species habitat likely to occur within area
Lamna nasus Porbeagle, Mackerel Shark [83288]		Species or species habitat may occur within area
Lepidochelys olivacea Olive Ridley Turtle, Pacific Ridley Turtle [1767]	Endangered	Foraging, feeding or related behaviour known 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 known to 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 known to occur within area
Megaptera novaeangliae Humpback Whale [38]	Vulnerable	Breeding known to occur

Name	Threatened	Type of Presence
		within area
Natator depressus Flatback Turtle [59257]	Vulnerable	Breeding known to occur within area
Orcaella heinsohni Australian Snubfin Dolphin [81322]		Species or species habitat 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	Breeding known to occur within area
Pristis pristis Freshwater Sawfish, Largetooth Sawfish, River Sawfish, Leichhardt's Sawfish, Northern Sawfish [60756]	Vulnerable	Species or species habitat known to occur within area
Pristis zijsron Green Sawfish, Dindagubba, Narrowsnout Sawfish [68442]	Vulnerable	Breeding 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]		Breeding known to occur within area
Tursiops aduncus (Arafura/Timor Sea populations) Spotted Bottlenose Dolphin (Arafura/Timor Sea populations) [78900]		Species or species habitat known to occur within area
Migratory Terrestrial Species		
Cecropis daurica Red-rumped Swallow [80610]		Species or species habitat may occur within area
Cuculus optatus Oriental Cuckoo, Horsfield's Cuckoo [86651]		Species or species habitat may occur within area
Hirundo rustica Barn Swallow [662]		Species or species habitat may occur within area
Motacilla cinerea Grey Wagtail [642]		Species or species habitat may occur within area
Motacilla flava Yellow Wagtail [644]		Species or species habitat likely to occur within area
Migratory Wetlands Species		
Acrocephalus orientalis Oriental Reed-Warbler [59570]		Species or species habitat may occur within area
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat known to occur within area
Arenaria interpres Ruddy Turnstone [872]		Species or species habitat known to occur within area

Name	Threatened	Type of Presence
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat known to occur within area
Calidris alba Sanderling [875]		Species or species habitat known to occur within area
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat known to occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat known to occur within area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat known to occur within area
Calidris ruficollis Red-necked Stint [860]		Species or species habitat known to occur within area
Calidris tenuirostris Great Knot [862]	Critically Endangered	Species or species habitat known to occur within area
Charadrius leschenaultii Greater Sand Plover, Large Sand Plover [877]	Vulnerable	Species or species habitat known to occur within area
Charadrius veredus Oriental Plover, Oriental Dotterel [882]		Species or species habitat may occur within area
Glareola maldivarum Oriental Pratincole [840]		Species or species habitat may occur within area
Limosa lapponica Bar-tailed Godwit [844]		Species or species habitat known to occur within area
Limosa limosa Black-tailed Godwit [845]		Species or species habitat known to occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat known to occur within area
Numenius phaeopus Whimbrel [849]		Species or species habitat known to occur within area
Pandion haliaetus Osprey [952]		Breeding known to occur within area
Pluvialis squatarola Grey Plover [865]		Species or species habitat known to occur within area
Thalasseus bergii Greater Crested Tern [83000]		Breeding known to occur within area
Tringa brevipes Grey-tailed Tattler [851]		Species or species habitat known to occur within area
Tringa glareola Wood Sandpiper [829]		Species or species habitat known to occur

Name	Threatened	Type of Presence
		within area
Tringa nebularia Common Greenshank, Greenshank [832]		Species or species habitat known to occur within area
Xenus cinereus Terek Sandpiper [59300]		Species or species habitat known to occur within area

Other Matters Protected by the EPBC Act

Commonwealth Heritage Places [Resource Information]

Name	State	Status
Natural		
Ningaloo Marine Area - Commonwealth Waters	WA	Listed place

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		
Acrocephalus orientalis Oriental Reed-Warbler [59570]		Species or species habitat may occur within area
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat known to occur within area
Anous stolidus Common Noddy [825]		Species or species habitat likely to occur within area
Anous tenuirostris melanops Australian Lesser Noddy [26000]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Anseranas semipalmata Magpie Goose [978]		Species or species habitat may occur within area
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Ardea ibis Cattle Egret [59542]		Species or species habitat may occur within area
Arenaria interpres Ruddy Turnstone [872]		Species or species habitat known to occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat known to occur within area
Calidris alba Sanderling [875]		Species or species

Name	Threatened	Type of Presence
		habitat known to occur within area
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat known to occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat known to occur within area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat known to occur within area
Calidris ruficollis Red-necked Stint [860]		Species or species habitat known to occur within area
Calidris tenuirostris Great Knot [862]	Critically Endangered	Species or species habitat known to occur within area
Calonectris leucomelas Streaked Shearwater [1077]		Species or species habitat known to occur within area
Catharacta skua Great Skua [59472]		Species or species habitat may occur within area
Charadrius leschenaultii Greater Sand Plover, Large Sand Plover [877]	Vulnerable	Species or species habitat known to occur within area
Charadrius ruficapillus Red-capped Plover [881]		Species or species habitat known to occur within area
Charadrius veredus Oriental Plover, Oriental Dotterel [882]		Species or species habitat may occur within area
Chrysococcyx osculans Black-eared Cuckoo [705]		Species or species habitat likely to occur within area
Diomedea amsterdamensis Amsterdam Albatross [64405]	Endangered	Species or species habitat likely to occur within area
Diomedea exulans Wandering Albatross [89223]	Vulnerable	Species or species habitat may occur within area
Fregata ariel Lesser Frigatebird, Least Frigatebird [1012]		Species or species habitat known to occur within area
Fregata minor Great Frigatebird, Greater Frigatebird [1013]		Species or species habitat likely to occur within area
Glareola maldivarum Oriental Pratincole [840]		Species or species habitat may occur within area
Haliaeetus leucogaster White-bellied Sea-Eagle [943]		Species or species habitat known to occur within area
Heteroscelus brevipes Grey-tailed Tattler [59311]		Species or species habitat known to occur

Name	Threatened	Type of Presence
		within area
Himantopus himantopus Pied Stilt, Black-winged Stilt [870]		Species or species habitat known to occur within area
Hirundo daurica Red-rumped Swallow [59480]		Species or species habitat may occur within area
Hirundo rustica Barn Swallow [662]		Species or species habitat may occur within area
Larus novaehollandiae Silver Gull [810]		Breeding known to occur within area
Larus pacificus Pacific Gull [811]		Foraging, feeding or related behaviour known to occur within area
Limosa lapponica Bar-tailed Godwit [844]		Species or species habitat known to occur within area
Limosa limosa Black-tailed Godwit [845]		Species or species habitat known to occur within area
Macronectes giganteus Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Species or species habitat may occur within area
Macronectes halli Northern Giant Petrel [1061]	Vulnerable	Species or species habitat may occur within area
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area
Motacilla cinerea Grey Wagtail [642]		Species or species habitat may occur within area
Motacilla flava Yellow Wagtail [644]		Species or species habitat likely to occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat known to occur within area
Numenius phaeopus Whimbrel [849]		Species or species habitat known to occur within area
Pandion haliaetus Osprey [952]		Breeding known to occur within area
Papasula abbotti Abbott's Booby [59297]	Endangered	Species or species habitat may occur within area
Phaethon lepturus White-tailed Tropicbird [1014]		Foraging, feeding or related behaviour likely to occur within area
Pluvialis squatarola Grey Plover [865]		Species or species habitat known to occur within area
Pterodroma macroptera Great-winged Petrel [1035]		Foraging, feeding or

Name	Threatened	Type of Presence
		related behaviour known to occur within area
Pterodroma mollis Soft-plumaged Petrel [1036]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Puffinus assimilis Little Shearwater [59363]		Foraging, feeding or related behaviour known to occur within area
Puffinus carneipes Flesh-footed Shearwater, Fleshy-footed Shearwater [1043]		Species or species habitat likely to occur within area
Puffinus pacificus Wedge-tailed Shearwater [1027]		Breeding known to occur within area
Recurvirostra novaehollandiae Red-necked Avocet [871]		Species or species habitat known to occur within area
Rostratula benghalensis (sensu lato) Painted Snipe [889]	Endangered*	Species or species habitat likely to occur within area
Sterna albifrons Little Tern [813]		Breeding known to occur within area
Sterna anaethetus Bridled Tern [814]		Breeding known to occur within area
Sterna bengalensis Lesser Crested Tern [815]		Breeding known to occur within area
Sterna bergii Crested Tern [816]		Breeding known to occur within area
Sterna caspia Caspian Tern [59467]		Breeding known to occur within area
Sterna dougallii Roseate Tern [817]		Breeding likely to occur within area
Sterna fuscata Sooty Tern [794]		Breeding known to occur within area
Sterna nereis Fairy Tern [796]		Breeding known to occur within area
Sula leucogaster Brown Booby [1022]		Breeding known to occur within area
Sula sula Red-footed Booby [1023]		Breeding known to occur within area
Thalassarche carteri Indian Yellow-nosed Albatross [64464]	Vulnerable	Foraging, feeding or related behaviour may occur within area
Thalassarche cauta Shy Albatross [89224]	Endangered	Species or species habitat may occur within area
Thalassarche impavida Campbell Albatross, Campbell Black-browed Albatross [64459]	Vulnerable	Species or species habitat may occur within area
Thalassarche melanophris Black-browed Albatross [66472]	Vulnerable	Species or species habitat may occur within area

Name	Threatened	Type of Presence
Thalassarche steadi White-capped Albatross [64462]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Tringa glareola Wood Sandpiper [829]		Species or species habitat known to occur within area
Tringa nebularia Common Greenshank, Greenshank [832]		Species or species habitat known to occur within area
Xenus cinereus Terek Sandpiper [59300]		Species or species habitat known to occur within area
Fish		
Acentronura larsonae Helen's Pygmy Pipehorse [66186]		Species or species habitat may occur within area
Bhanotia fasciolata Corrugated Pipefish, Barbed Pipefish [66188]		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 galei Gale's Pipefish [66191]		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 amplexus Fijian Banded Pipefish, Brown-banded Pipefish [66199]		Species or species habitat may occur within area
Corythoichthys flavofasciatus Reticulate Pipefish, Yellow-banded Pipefish, Network Pipefish [66200]		Species or species habitat may occur within area
Corythoichthys intestinalis Australian Messmate Pipefish, Banded Pipefish [66202]		Species or species habitat may occur within area
Corythoichthys schultzi Schultz's Pipefish [66205]		Species or species habitat may occur within area
Cosmocampus banneri Roughridge Pipefish [66206]		Species or species habitat may occur within area
Doryrhamphus dactyliophorus Banded Pipefish, Ringed Pipefish [66210]		Species or species habitat may occur within area

Name	Threatened	Type of Presence
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 dunckeri Red-hair Pipefish, Duncker's Pipefish [66220]		Species or species habitat may occur within area
Halicampus grayi Mud Pipefish, Gray's Pipefish [66221]		Species or species habitat may occur within area
Halicampus nitidus Glittering Pipefish [66224]		Species or species habitat may occur within area
Halicampus spinirostris Spiny-snout Pipefish [66225]		Species or species habitat may occur within area
Haliichthys taeniophorus Ribboned Pipehorse, Ribboned Seadragon [66226]		Species or species habitat may occur within area
Hippichthys 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

Name	Threatened	Type of Presence
Hippocampus trimaculatus		
Three-spot Seahorse, Low-crowned Seahorse, Flat-faced Seahorse [66720]		Species or species habitat may occur within area
Lissocampus fatiloquus		
Prophet's Pipefish [66250]		Species or species habitat may occur within area
Micrognathus micronotopterus		
Tidepool Pipefish [66255]		Species or species habitat may occur within area
Nannocampus subosseus		
Bonyhead Pipefish, Bony-headed Pipefish [66264]		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
Stigmatopora argus		
Spotted Pipefish, Gulf Pipefish, Peacock Pipefish [66276]		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
Mammals		
Dugong dugon		
Dugong [28]		Breeding known to occur within area
Neophoca cinerea		
Australian Sea-lion, Australian Sea Lion [22]	Endangered	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 known to occur within area
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

Name	Threatened	Type of Presence
Aipysurus foliosquama Leaf-scaled Seasnake [1118]	Critically Endangered	Species or species habitat likely to occur within area
Aipysurus laevis Olive Seasnake [1120]		Species or species habitat may occur within area
Aipysurus pooleorum Shark Bay Seasnake [66061]		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	Breeding known to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Breeding known to occur within area
Crocodylus johnstoni Freshwater Crocodile, Johnston's Crocodile, Johnstone's Crocodile [1773]		Species or species habitat may occur within area
Crocodylus porosus Salt-water Crocodile, Estuarine Crocodile [1774]		Species or species habitat likely to occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Foraging, feeding or related behaviour known to occur within area
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
Enhydrina schistosa Beaked Seasnake [1126]		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	Breeding known to occur within area
Hydrelaps darwiniensis Black-ringed Seasnake [1100]		Species or species habitat may occur within area
Hydrophis atriceps Black-headed Seasnake [1101]		Species or species habitat may occur within area
Hydrophis coggeri Slender-necked Seasnake [25925]		Species or species habitat may occur within area

Name	Threatened	Type of Presence
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 inornatus Plain Seasnake [1107]		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
Lapemis hardwickii Spine-bellied Seasnake [1113]		Species or species habitat may occur within area
Lepidochelys olivacea Olive Ridley Turtle, Pacific Ridley Turtle [1767]	Endangered	Foraging, feeding or related behaviour known to occur within area
Natator depressus Flatback Turtle [59257]	Vulnerable	Breeding 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 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 likely to occur within area
Feresa attenuata Pygmy Killer Whale [61]		Species or species habitat may occur within

Name	Status	Type of Presence
		area
Globicephala macrorhynchus Short-finned Pilot Whale [62]		Species or species habitat may occur within area
Globicephala melas Long-finned Pilot Whale [59282]		Species or species habitat may occur within area
Grampus griseus Risso's Dolphin, Grampus [64]		Species or species habitat may occur within area
Indopacetus pacificus Longman's Beaked Whale [72]		Species or species habitat may occur within area
Kogia breviceps Pygmy Sperm Whale [57]		Species or species habitat may occur within area
Kogia 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	Breeding known to occur within area
Mesoplodon densirostris Blainville's Beaked Whale, Dense-beaked Whale [74]		Species or species habitat may occur within area
Mesoplodon ginkgodens Gingko-toothed Beaked Whale, Gingko-toothed Whale, Gingko Beaked Whale [59564]		Species or species habitat may occur within area
Mesoplodon grayi Gray's Beaked Whale, Scamperdown Whale [75]		Species or species habitat may occur within area
Orcaella brevirostris Irrawaddy Dolphin [45]		Species or species habitat known to occur within area
Orcinus orca Killer Whale, Orca [46]		Species or species habitat may occur within area
Peponocephala electra Melon-headed Whale [47]		Species or species habitat may occur within area
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]		Breeding known to occur within area
Stenella attenuata Spotted Dolphin, Pantropical Spotted Dolphin [51]		Species or species habitat may occur within area
Stenella coeruleoalba Striped Dolphin, Euphrosyne Dolphin [52]		Species or species

Name	Status	Type of Presence
		habitat may occur within area
Stenella longirostris Long-snouted Spinner Dolphin [29]		Species or species habitat may occur within area
Steno bredanensis Rough-toothed Dolphin [30]		Species or species habitat may occur within area
Tursiops aduncus Indian Ocean Bottlenose Dolphin, Spotted Bottlenose Dolphin [68418]		Species or species habitat likely to occur within area
Tursiops aduncus (Arafura/Timor Sea populations) Spotted Bottlenose Dolphin (Arafura/Timor Sea populations) [78900]		Species or species habitat known to occur within area
Tursiops truncatus s. str. Bottlenose Dolphin [68417]		Species or species habitat may occur within area
Ziphius cavirostris Cuvier's Beaked Whale, Goose-beaked Whale [56]		Species or species habitat may occur within area

Australian Marine Parks [Resource Information]

Name	Label
Abrolhos	Habitat Protection Zone (IUCN IV)
Abrolhos	Multiple Use Zone (IUCN VI)
Abrolhos	Special Purpose Zone (IUCN VI)
Argo-Rowley Terrace	Multiple Use Zone (IUCN VI)
Argo-Rowley Terrace	National Park Zone (IUCN II)
Dampier	Habitat Protection Zone (IUCN IV)
Dampier	Multiple Use Zone (IUCN VI)
Eighty Mile Beach	Multiple Use Zone (IUCN VI)
Gascoyne	Habitat Protection Zone (IUCN IV)
Gascoyne	Multiple Use Zone (IUCN VI)
Gascoyne	National Park Zone (IUCN II)
Joseph Bonaparte Gulf	Multiple Use Zone (IUCN VI)
Kimberley	Multiple Use Zone (IUCN VI)
Ningaloo	Recreational Use Zone (IUCN IV)
Oceanic Shoals	Multiple Use Zone (IUCN VI)
Roebuck	Multiple Use Zone (IUCN VI)
Shark Bay	Multiple Use Zone (IUCN VI)

Extra Information

State and Territory Reserves [Resource Information]

Name	State
Bardi Jawi	WA
Dambimangari	WA
Dambimangari	WA
Dirk Hartog Island	WA
Faure Island	WA
Little Rocky Island	WA
Tent Island	WA
Unnamed WA36913	WA
Unnamed WA36915	WA
Uunguu	WA

Invasive Species [Resource Information]

Weeds reported here are the 20 species of national significance (WoNS), along with other introduced plants that are considered by the States and Territories to pose a particularly significant threat to biodiversity. The following feral animals are reported: Goat, Red Fox, Cat, Rabbit, Pig, Water Buffalo and Cane Toad. Maps from Landscape Health Project, National Land and Water Resouces Audit, 2001.

Name	Status	Type of Presence
Birds		
Columba livia		
Rock Pigeon, Rock Dove, Domestic Pigeon [803]		Species or species habitat likely to occur within area
Passer montanus		
Eurasian Tree Sparrow [406]		Species or species habitat likely to occur within area
Streptopelia senegalensis		
Laughing Turtle-dove, Laughing Dove [781]		Species or species habitat likely to occur within area
Frogs		
Rhinella marina		
Cane Toad [83218]		Species or species habitat may occur within area
Mammals		
Canis lupus familiaris		
Domestic Dog [82654]		Species or species habitat likely to occur within area
Capra hircus		
Goat [2]		Species or species habitat likely to occur within area
Equus asinus		
Donkey, Ass [4]		Species or species habitat likely to occur within area
Equus caballus		
Horse [5]		Species or species habitat likely to occur within area
Felis catus		
Cat, House Cat, Domestic Cat [19]		Species or species habitat likely to occur within area
Mus musculus		
House Mouse [120]		Species or species habitat likely to occur within area
Oryctolagus cuniculus		
Rabbit, European Rabbit [128]		Species or species habitat likely to occur within area
Rattus rattus		
Black Rat, Ship Rat [84]		Species or species habitat likely to occur within area
Sus scrofa		
Pig [6]		Species or species habitat likely to occur within area
Vulpes vulpes		
Red Fox, Fox [18]		Species or species habitat likely to occur within area
Plants		
Andropogon gayanus		
Gamba Grass [66895]		Species or species habitat likely to occur within area
Cenchrus ciliaris		
Buffel-grass, Black Buffel-grass [20213]		Species or species

Name	Status	Type of Presence
		habitat likely to occur within area
Jatropha gossypifolia Cotton-leaved Physic-Nut, Bellyache Bush, Cotton-leaf Physic Nut, Cotton-leaf Jatropha, Black Physic Nut [7507]		Species or species habitat likely to occur within area
Lantana camara Lantana, Common Lantana, Kamara Lantana, Large-leaf Lantana, Pink Flowered Lantana, Red Flowered Lantana, Red-Flowered Sage, White Sage, Wild Sage [10892]		Species or species habitat may occur within area
Lycium ferocissimum African Boxthorn, Boxthorn [19235]		Species or species habitat likely to occur within area
Opuntia spp. Prickly Pears [82753]		Species or species habitat likely to occur within area
Parkinsonia aculeata Parkinsonia, Jerusalem Thorn, Jelly Bean Tree, Horse Bean [12301]		Species or species habitat likely to occur within area
Tamarix aphylla Athel Pine, Athel Tree, Tamarisk, Athel Tamarisk, Athel Tamarix, Desert Tamarisk, Flowering Cypress, Salt Cedar [16018]		Species or species habitat likely to occur within area
Reptiles		
Ramphotyphlops braminus Flowerpot Blind Snake, Brahminy Blind Snake, Cacing Besi [1258]		Species or species habitat likely to occur within area

Nationally Important Wetlands [Resource Information]

Name	State
Exmouth Gulf East	WA
Hamelin Pool	WA
Shark Bay East	WA

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
Carbonate bank and terrace system of the Sahul	North-west
Commonwealth waters adjacent to Ningaloo Reef	North-west
Continental Slope Demersal Fish Communities	North-west
Pinnacles of the Bonaparte Basin	North-west
Wallaby Saddle	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

-11.269933 127.440005,-12.516962 128.274966,-13.416271 128.362857,-13.854015 128.406802,-14.652617 128.879214,-14.833236 128.956119,-14.737633 128.439761,-14.280288 127.769595,-13.864681 127.385074,-13.864681 127.143375,-13.67261 126.934634,-13.875347 126.418277,-13.843348 126.242496,-13.896678 125.967837,-14.077907 125.934878,-14.34416 125.836001,-14.216398 125.649234,-14.461212 125.099918,-14.641988 125.044986,-14.88633 125.143863,-14.971254 124.990054,-15.257624 124.649478,-15.268222 124.231998,-15.416549 124.16608,-15.490673 124.407779,-16.293713 124.286929,-16.072142 123.616763,-16.219884 123.429996,-16.567693 123.408023,-16.778181 123.561832,-16.914874 123.704654,-17.114478 123.397037,-16.546631 123.034488,-16.251529 123.078433,-16.704537 122.540103,-17.135476 122.144595,-17.502564 122.056705,-18.244939 122.078677,-18.432649 121.738101,-18.76585 121.551334,-19.45099 121.100894,-19.999097 119.584781,-19.906155 119.101382,-20.236365 118.727847,-20.308506 118.112613,-20.648142 117.321597,-20.555589 116.948062,-20.360014 117.01398,-20.318809 116.816226,-20.802273 116.26691,-20.822812 116.113101,-21.468342 115.377017,-21.754335 114.629947,-22.344932 114.355289,-22.202601 114.146548,-21.67268 114.245425,-21.886924 113.849918,-22.669716 113.586246,-23.003846 113.751041,-23.458145 113.696109,-24.031352 113.300601,-24.51208 113.311587,-25.893759 114.135562,-26.258875 114.003726,-25.953045 113.926822,-25.398562 113.45441,-25.686027 113.366519,-26.249022 113.641177,-26.229314 113.509341,-25.378711 112.949039,-25.557248 112.839175,-26.485263 113.256656,-27.161748 113.816959,-27.571531 114.036685,-27.552052 113.113834,-27.151972 112.981998,-25.368784 112.278873,-26.022173 110.389224,-25.893759 110.323306,-25.804776 109.872867,-25.537424 109.587222,-25.626608 109.23566,-24.582033 109.389468,-23.306884 109.872867,-22.882439 110.026675,-21.621623 110.169498,-20.945986 110.510074,-20.030065 110.949527,-19.025706 112.092105,-17.816621 112.981998,-17.271909 113.773013,-16.935895 115.442935,-15.681156 116.014224,-14.790751 116.89313,-14.056594 118.266421,-13.266614 118.42023,-13.949995 120.046207,-13.234532 121.825992,-12.838516 122.529117,-12.15205 122.51813,-11.883411 122.726871,-11.786636 123.067447,-11.926411 123.440982,-12.248693 123.583804,-11.63603 125.737125,-11.334573 126.539126,-11.280707 127.440005,-11.269933 127.440005

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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Department of Agriculture,
Water and the Environment

EPBC Act Protected Matters Report

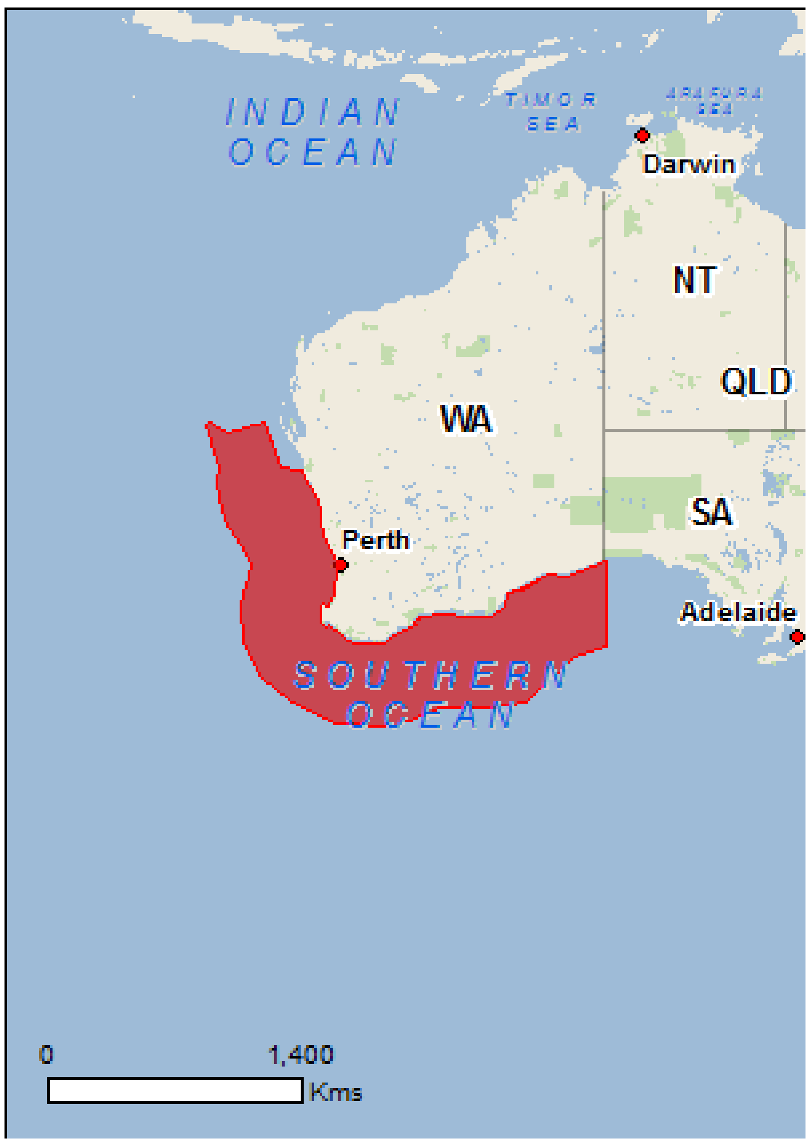
This report provides general guidance on matters of national environmental significance and other matters protected by the EPBC Act in the area you have selected.

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.

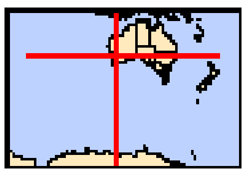
Report created: 10/05/21 12:51:00

- Summary
- Details
  - Matters of NES
  - Other Matters Protected by the EPBC Act
  - Extra Information
- Caveat
- Acknowledgements



This map may contain data which are ©Commonwealth of Australia (Geoscience Australia), ©PSMA 2015

Coordinates
Buffer: 1.0Km



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:	1
Wetlands of International Importance:	4
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	2
Listed Threatened Ecological Communities:	3
Listed Threatened Species:	65
Listed Migratory Species:	67

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:	2
Commonwealth Heritage Places:	1
Listed Marine Species:	106
Whales and Other Cetaceans:	40
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Australian Marine Parks:	21

Extra Information

This part of the report provides information that may also be relevant to the area you have nominated.

State and Territory Reserves:	10
Regional Forest Agreements:	None
Invasive Species:	42
Nationally Important Wetlands:	None
Key Ecological Features (Marine)	8

Details

Matters of National Environmental Significance

National Heritage Properties

[Resource Information]

Name	State	Status
Indigenous		
Cheetup Rock Shelter	WA	Listed place

Wetlands of International Importance (Ramsar)

[Resource Information]

Name	Proximity
Becher point wetlands	Within 10km of Ramsar
Forrestdale and thomsons lakes	Within 10km of Ramsar
Peel-yalgorup system	Within 10km of Ramsar
Vasse-wonnerup system	Within 10km of Ramsar

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
Extended Continental Shelf

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
South-west

Listed Threatened Ecological Communities

[Resource Information]

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.

Name	Status	Type of Presence
Banksia Woodlands of the Swan Coastal Plain ecological community	Endangered	Community may occur within area
Proteaceae Dominated Kwongkan Shrublands of the Southeast Coastal Floristic Province of Western Australia	Endangered	Community may occur within area
Tuart (Eucalyptus gomphocephala) Woodlands and Forests of the Swan Coastal Plain ecological community	Critically Endangered	Community likely to occur within area

Listed Threatened Species

[Resource Information]

Name	Status	Type of Presence
Birds		
Anous tenuirostris melanops Australian Lesser Noddy [26000]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Atrichornis clamosus Noisy Scrub-bird, Tjimiluk [654]	Endangered	Species or species habitat known to occur within area
Botaurus poiciloptilus Australasian Bittern [1001]	Endangered	Species or species habitat likely to occur within area

Name	Status	Type of Presence
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat known to occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat known to occur within area
Calidris tenuirostris Great Knot [862]	Critically Endangered	Species or species habitat known to occur within area
Calyptorhynchus banksii naso Forest Red-tailed Black-Cockatoo, Karrak [67034]	Vulnerable	Species or species habitat likely to occur within area
Calyptorhynchus latirostris Carnaby's Cockatoo, Short-billed Black-Cockatoo [59523]	Endangered	Species or species habitat known to occur within area
Cereopsis novaehollandiae grisea Cape Barren Goose (south-western), Recherche Cape Barren Goose [25978]	Vulnerable	Breeding known to occur within area
Charadrius leschenaultii Greater Sand Plover, Large Sand Plover [877]	Vulnerable	Species or species habitat known to occur within area
Charadrius mongolus Lesser Sand Plover, Mongolian Plover [879]	Endangered	Species or species habitat known to occur within area
Diomedea amsterdamensis Amsterdam Albatross [64405]	Endangered	Species or species habitat likely to occur within area
Diomedea antipodensis Antipodean Albatross [64458]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea dabbenena Tristan Albatross [66471]	Endangered	Species or species habitat likely to occur within area
Diomedea epomophora Southern Royal Albatross [89221]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea exulans Wandering Albatross [89223]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea sanfordi Northern Royal Albatross [64456]	Endangered	Foraging, feeding or related behaviour likely to occur within area
Falco hypoleucos Grey Falcon [929]	Vulnerable	Species or species habitat likely to occur within area
Halobaena caerulea Blue Petrel [1059]	Vulnerable	Species or species habitat may occur within area
Leipoa ocellata Malleefowl [934]	Vulnerable	Species or species habitat may occur within area
Limosa lapponica menzbieri Northern Siberian Bar-tailed Godwit, Russkoye Bar-tailed Godwit [86432]	Critically Endangered	Species or species habitat known to occur within area
Macronectes giganteus Southern Giant-Petrel, Southern Giant Petrel	Endangered	Species or species

Name	Status	Type of Presence
[1060]		habitat may occur within area
Macronectes halli Northern Giant Petrel [1061]	Vulnerable	Species or species habitat may occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat likely to occur within area
Pachyptila turtur subantarctica Fairy Prion (southern) [64445]	Vulnerable	Species or species habitat known to occur within area
Pezoporus flaviventris Western Ground Parrot, Kyloring [84650]	Critically Endangered	Species or species habitat likely to occur within area
Phoebetria fusca Sooty Albatross [1075]	Vulnerable	Species or species habitat likely to occur within area
Pterodroma mollis Soft-plumaged Petrel [1036]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Rostratula australis Australian Painted Snipe [77037]	Endangered	Species or species habitat known to occur within area
Sternula nereis nereis Australian Fairy Tern [82950]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Thalassarche carteri Indian Yellow-nosed Albatross [64464]	Vulnerable	Foraging, feeding or related behaviour may occur within area
Thalassarche cauta Shy Albatross [89224]	Endangered	Foraging, feeding or related behaviour likely to occur within area
Thalassarche chrysostoma Grey-headed Albatross [66491]	Endangered	Species or species habitat may occur within area
Thalassarche impavida Campbell Albatross, Campbell Black-browed Albatross [64459]	Vulnerable	Species or species habitat may occur within area
Thalassarche melanophris Black-browed Albatross [66472]	Vulnerable	Species or species habitat may occur within area
Thalassarche steadi White-capped Albatross [64462]	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 to occur within area
Bettongia penicillata ogilbyi Woylie [66844]	Endangered	Species or species habitat may occur within

Name	Status	Type of Presence
		area
Dasyurus geoffroii Chuditch, Western Quoll [330]	Vulnerable	Species or species habitat may occur within area
Eubalaena australis Southern Right Whale [40]	Endangered	Breeding known to occur within area
Megaptera novaeangliae Humpback Whale [38]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Neophoca cinerea Australian Sea-lion, Australian Sea Lion [22]	Endangered	Breeding known to occur within area
Parantechinus apicalis Dibbler [313]	Endangered	Species or species habitat known to occur within area
Petrogale lateralis hacketti Recherche Rock-wallaby [66849]	Vulnerable	Species or species habitat known to occur within area
Potorous gilbertii Gilbert's Potoroo, Ngilkat [66642]	Critically Endangered	Translocated population known to occur within area
Pseudocheirus occidentalis Western Ringtail Possum, Ngwayir, Womp, Woder, Ngoor, Ngoolangit [25911]	Critically Endangered	Species or species habitat may occur within area
Setonix brachyurus Quokka [229]	Vulnerable	Species or species habitat known to occur within area
Plants		
Caladenia elegans Elegant Spider-orchid [56775]	Endangered	Species or species habitat may occur within area
Caladenia granitora [65292]	Endangered	Species or species habitat may occur within area
Caladenia hoffmanii Hoffman's Spider-orchid [56719]	Endangered	Species or species habitat may occur within area
Diuris micrantha Dwarf Bee-orchid [55082]	Vulnerable	Species or species habitat likely to occur within area
Drummondita ericoides Morseby Range Drummondita [9193]	Endangered	Species or species habitat likely to occur within area
Eucalyptus insularis Twin Peak Island Mallee [3057]	Endangered	Species or species habitat likely to occur within area
Isopogon uncinatus Albany Cone Bush, Hook-leaf Isopogon [20871]	Endangered	Species or species habitat likely to occur within area
Reptiles		
Caretta caretta Loggerhead Turtle [1763]	Endangered	Foraging, feeding or related behaviour known to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Foraging, feeding or related behaviour known to occur within area

Name	Status	Type of Presence
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Foraging, feeding or related behaviour known to occur within area
Egernia stokesii badia Western Spiny-tailed Skink, Baudin Island Spiny-tailed Skink [64483]	Endangered	Species or species habitat may occur within area
Liopholis pulchra longicauda Jurien Bay Skink, Jurien Bay Rock-skink [83162]	Vulnerable	Species or species habitat known to occur within area
Natator depressus Flatback Turtle [59257]	Vulnerable	Foraging, feeding or related behaviour 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	Foraging, feeding or related behaviour known to occur within area
Rhincodon typus Whale Shark [66680]	Vulnerable	Species or species habitat may 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 likely to occur within area
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Ardenna carneipes Flesh-footed Shearwater, Fleshy-footed Shearwater [82404]		Breeding known to occur within area
Ardenna grisea Sooty Shearwater [82651]		Species or species habitat may occur within area
Ardenna pacifica Wedge-tailed Shearwater [84292]		Breeding known to occur within area
Ardenna tenuirostris Short-tailed Shearwater [82652]		Breeding known to occur within area
Diomedea amsterdamensis Amsterdam Albatross [64405]	Endangered	Species or species habitat likely to occur within area
Diomedea antipodensis Antipodean Albatross [64458]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea dabbenena Tristan Albatross [66471]	Endangered	Species or species habitat likely to occur within area
Diomedea epomophora Southern Royal Albatross [89221]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area

Name	Threatened	Type of Presence
Diomedea exulans Wandering Albatross [89223]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea sanfordi Northern Royal Albatross [64456]	Endangered	Foraging, feeding or related behaviour likely to occur within area
Fregata ariel Lesser Frigatebird, Least Frigatebird [1012]		Species or species habitat likely to occur within area
Hydroprogne caspia Caspian Tern [808]		Breeding known to occur within area
Macronectes giganteus Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Species or species habitat may occur within area
Macronectes halli Northern Giant Petrel [1061]	Vulnerable	Species or species habitat may occur within area
Onychoprion anaethetus Bridled Tern [82845]		Breeding known to occur within area
Phoebetria fusca Sooty Albatross [1075]	Vulnerable	Species or species habitat likely to occur within area
Sterna dougallii Roseate Tern [817]		Breeding known to occur within area
Thalassarche carteri Indian Yellow-nosed Albatross [64464]	Vulnerable	Foraging, feeding or related behaviour may occur within area
Thalassarche cauta Shy Albatross [89224]	Endangered	Foraging, feeding or related behaviour likely to occur within area
Thalassarche chrysostoma Grey-headed Albatross [66491]	Endangered	Species or species habitat may occur within area
Thalassarche impavida Campbell Albatross, Campbell Black-browed Albatross [64459]	Vulnerable	Species or species habitat may occur within area
Thalassarche melanophris Black-browed Albatross [66472]	Vulnerable	Species or species habitat may occur within area
Thalassarche steadi White-capped Albatross [64462]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Migratory Marine Species		
Balaena glacialis australis Southern Right Whale [75529]	Endangered*	Breeding known to 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

Name	Threatened	Type of Presence
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
Caperea marginata Pygmy Right Whale [39]		Foraging, feeding or related behaviour may occur within area
Carcharhinus longimanus Oceanic Whitetip Shark [84108]		Species or species habitat likely to occur within area
Carcharodon carcharias White Shark, Great White Shark [64470]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Caretta caretta Loggerhead Turtle [1763]	Endangered	Foraging, feeding or related behaviour known to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Foraging, feeding or related behaviour 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
Lagenorhynchus obscurus Dusky Dolphin [43]		Species or species habitat likely to occur within area
Lamna nasus Porbeagle, Mackerel Shark [83288]		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 known to 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 known to occur within area
Megaptera novaeangliae Humpback Whale [38]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Natator depressus Flatback Turtle [59257]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Orcinus orca Killer Whale, Orca [46]		Species or species habitat may occur within area
Physeter macrocephalus Sperm Whale [59]		Foraging, feeding or related behaviour known to occur within area
Rhincodon typus Whale Shark [66680]	Vulnerable	Species or species

Name	Threatened	Type of Presence
		habitat may occur within area
Migratory Terrestrial Species		
Motacilla cinerea Grey Wagtail [642]		Species or species habitat may occur within area
Migratory Wetlands Species		
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat known to occur within area
Arenaria interpres Ruddy Turnstone [872]		Species or species habitat known to occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat likely to occur within area
Calidris alba Sanderling [875]		Species or species habitat known to occur within area
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat known to occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat known to occur within area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat likely to occur within area
Calidris ruficollis Red-necked Stint [860]		Species or species habitat known to occur within area
Calidris tenuirostris Great Knot [862]	Critically Endangered	Species or species habitat known to occur within area
Charadrius leschenaultii Greater Sand Plover, Large Sand Plover [877]	Vulnerable	Species or species habitat known to occur within area
Charadrius mongolus Lesser Sand Plover, Mongolian Plover [879]	Endangered	Species or species habitat known to occur within area
Glareola maldivarum Oriental Pratincole [840]		Species or species habitat known to occur within area
Limosa lapponica Bar-tailed Godwit [844]		Species or species habitat known to occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat likely to occur within area
Pandion haliaetus Osprey [952]		Breeding known to occur within area
Thalasseus bergii Greater Crested Tern [83000]		Breeding known to occur within area
Tringa brevipes Grey-tailed Tattler [851]		Species or species habitat known to occur

Name	Threatened	Type of Presence
		within area
Tringa nebularia Common Greenshank, Greenshank [832]		Species or species habitat likely to occur within area

Other Matters Protected by the EPBC Act

Commonwealth Land [Resource Information]

The Commonwealth area listed below may indicate the presence of Commonwealth land in this vicinity. Due to the unreliability of the data source, all proposals should be checked as to whether it impacts on a Commonwealth area, before making a definitive decision. Contact the State or Territory government land department for further information.

Name
Commonwealth Land - Defence - HMAS STIRLING-ROCKINGHAM ;HMAS STIRLING - GARDEN ISLAND

Commonwealth Heritage Places [Resource Information]

Name	State	Status
Natural		
Garden Island	WA	Listed place

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 known to occur within area
Anous stolidus Common Noddy [825]		Species or species habitat likely to occur within area
Anous tenuirostris melanops Australian Lesser Noddy [26000]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Ardea ibis Cattle Egret [59542]		Species or species habitat may occur within area
Arenaria interpres Ruddy Turnstone [872]		Species or species habitat known to occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat likely to occur within area
Calidris alba Sanderling [875]		Species or species

Name	Threatened	Type of Presence
		habitat known to occur within area
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat known to occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat known to occur within area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat likely to occur within area
Calidris ruficollis Red-necked Stint [860]		Species or species habitat known to occur within area
Calidris tenuirostris Great Knot [862]	Critically Endangered	Species or species habitat known to occur within area
Catharacta skua Great Skua [59472]		Species or species habitat may occur within area
Cereopsis novaehollandiae grisea Cape Barren Goose (south-western), Recherche Cape Barren Goose [25978]	Vulnerable	Breeding known to occur within area
Charadrius leschenaultii Greater Sand Plover, Large Sand Plover [877]	Vulnerable	Species or species habitat known to occur within area
Charadrius mongolus Lesser Sand Plover, Mongolian Plover [879]	Endangered	Species or species habitat known to occur within area
Charadrius ruficapillus Red-capped Plover [881]		Species or species habitat known to occur within area
Chrysococcyx osculans Black-eared Cuckoo [705]		Species or species habitat likely to occur within area
Diomedea amsterdamensis Amsterdam Albatross [64405]	Endangered	Species or species habitat likely to occur within area
Diomedea antipodensis Antipodean Albatross [64458]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea dabbenena Tristan Albatross [66471]	Endangered	Species or species habitat likely to occur within area
Diomedea epomophora Southern Royal Albatross [89221]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea exulans Wandering Albatross [89223]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea sanfordi Northern Royal Albatross [64456]	Endangered	Foraging, feeding or related behaviour likely to occur within area
Eudyptula minor Little Penguin [1085]		Breeding known 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
Glareola maldivarum Oriental Pratincole [840]		Species or species habitat known to occur within area
Haliaeetus leucogaster White-bellied Sea-Eagle [943]		Species or species habitat known to occur within area
Halobaena caerulea Blue Petrel [1059]	Vulnerable	Species or species habitat may occur within area
Heteroscelus brevipes Grey-tailed Tattler [59311]		Species or species habitat known to occur within area
Larus novaehollandiae Silver Gull [810]		Breeding known to occur within area
Larus pacificus Pacific Gull [811]		Breeding known to occur within area
Limosa lapponica Bar-tailed Godwit [844]		Species or species habitat known to occur within area
Macronectes giganteus Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Species or species habitat may occur within area
Macronectes halli Northern Giant Petrel [1061]	Vulnerable	Species or species habitat may occur within area
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area
Motacilla cinerea Grey Wagtail [642]		Species or species habitat may occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat likely to occur within area
Pachyptila turtur Fairy Prion [1066]		Species or species habitat known to occur within area
Pandion haliaetus Osprey [952]		Breeding known to occur within area
Pelagodroma marina White-faced Storm-Petrel [1016]		Breeding known to occur within area
Phalacrocorax fuscescens Black-faced Cormorant [59660]		Breeding known to occur within area
Phoebetria fusca Sooty Albatross [1075]	Vulnerable	Species or species habitat likely to occur within area
Pterodroma macroptera Great-winged Petrel [1035]		Breeding known to occur within area
Pterodroma mollis Soft-plumaged Petrel [1036]	Vulnerable	Foraging, feeding or related behaviour likely

Name	Threatened	Type of Presence
		to occur within area
Puffinus assimilis		
Little Shearwater [59363]		Breeding known to occur within area
Puffinus carneipes		
Flesh-footed Shearwater, Fleshy-footed Shearwater [1043]		Breeding known to occur within area
Puffinus griseus		
Sooty Shearwater [1024]		Species or species habitat may occur within area
Puffinus pacificus		
Wedge-tailed Shearwater [1027]		Breeding known to occur within area
Puffinus tenuirostris		
Short-tailed Shearwater [1029]		Breeding known to occur within area
Rostratula benghalensis (sensu lato)		
Painted Snipe [889]	Endangered*	Species or species habitat known to occur within area
Sterna anaethetus		
Bridled Tern [814]		Breeding known to occur within area
Sterna bergii		
Crested Tern [816]		Breeding known to occur within area
Sterna caspia		
Caspian Tern [59467]		Breeding known to occur within area
Sterna dougallii		
Roseate Tern [817]		Breeding known to occur within area
Sterna fuscata		
Sooty Tern [794]		Breeding known to occur within area
Sterna nereis		
Fairy Tern [796]		Breeding known to occur within area
Thalassarche carteri		
Indian Yellow-nosed Albatross [64464]	Vulnerable	Foraging, feeding or related behaviour may occur within area
Thalassarche cauta		
Shy Albatross [89224]	Endangered	Foraging, feeding or related behaviour likely to occur within area
Thalassarche chrysostoma		
Grey-headed Albatross [66491]	Endangered	Species or species habitat may occur within area
Thalassarche impavida		
Campbell Albatross, Campbell Black-browed Albatross [64459]	Vulnerable	Species or species habitat may occur within area
Thalassarche melanophris		
Black-browed Albatross [66472]	Vulnerable	Species or species habitat may occur within area
Thalassarche steadi		
White-capped Albatross [64462]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thinornis rubricollis		
Hooded Plover [59510]		Species or species habitat known to occur within area
Tringa nebularia		
Common Greenshank, Greenshank [832]		Species or species habitat likely to occur within area
Fish		

Name	Threatened	Type of Presence
Acentronura australe Southern Pygmy Pipehorse [66185]		Species or species habitat may occur within area
Campichthys galei Gale's Pipefish [66191]		Species or species habitat may occur within area
Choeroichthys suillus Pig-snouted Pipefish [66198]		Species or species habitat may occur within area
Halicampus brocki Brock's Pipefish [66219]		Species or species habitat may occur within area
Heraldia nocturna Upside-down Pipefish, Eastern Upside-down Pipefish, Eastern Upside-down Pipefish [66227]		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 breviceps Short-head Seahorse, Short-snouted Seahorse [66235]		Species or species habitat may occur within area
Hippocampus subelongatus West Australian Seahorse [66722]		Species or species habitat may occur within area
Histiogamphelus cristatus Rhino Pipefish, Macleay's Crested Pipefish, Ring-back Pipefish [66243]		Species or species habitat may occur within area
Leptoichthys fistularius Brushtail Pipefish [66248]		Species or species habitat may occur within area
Lissocampus caudalis Australian Smooth Pipefish, Smooth Pipefish [66249]		Species or species habitat may occur within area
Lissocampus fatiloquus Prophet's Pipefish [66250]		Species or species habitat may occur within area
Lissocampus runa Javelin Pipefish [66251]		Species or species habitat may occur within area
Maroubra perserrata Sawtooth Pipefish [66252]		Species or species habitat may occur within area
Mitotichthys meraculus Western Crested Pipefish [66259]		Species or species habitat may occur within area
Nannocampus subosseus Bonyhead Pipefish, Bony-headed Pipefish [66264]		Species or species habitat may occur within area
Notiocampus ruber Red Pipefish [66265]		Species or species habitat may occur within area
Phycodurus eques Leafy Seadragon [66267]		Species or species habitat may occur within area

Name	Threatened	Type of Presence
Phyllopteryx taeniolatus Common Seadragon, Weedy Seadragon [66268]		Species or species habitat may occur within area
Pugnaso curtirostris Pugnose Pipefish, Pug-nosed Pipefish [66269]		Species or species habitat may occur within area
Solegnathus lettiensis Gunther's Pipehorse, Indonesian Pipefish [66273]		Species or species habitat may occur within area
Stigmatopora argus Spotted Pipefish, Gulf Pipefish, Peacock Pipefish [66276]		Species or species habitat may occur within area
Stigmatopora nigra Widebody Pipefish, Wide-bodied Pipefish, Black Pipefish [66277]		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
Urocampus carinirostris Hairy Pipefish [66282]		Species or species habitat may occur within area
Vanacampus margaritifer Mother-of-pearl Pipefish [66283]		Species or species habitat may occur within area
Vanacampus phillipi Port Phillip Pipefish [66284]		Species or species habitat may occur within area
Vanacampus poecilolaemus Longsnout Pipefish, Australian Long-snout Pipefish, Long-snouted Pipefish [66285]		Species or species habitat may occur within area
Mammals		
Arctocephalus forsteri Long-nosed Fur-seal, New Zealand Fur-seal [20]		Breeding known to occur within area
Neophoca cinerea Australian Sea-lion, Australian Sea Lion [22]	Endangered	Breeding known to occur within area
Reptiles		
Aipysurus laevis Olive Seasnake [1120]		Species or species habitat may occur within area
Aipysurus pooleorum Shark Bay Seasnake [66061]		Species or species habitat may occur within area
Caretta caretta Loggerhead Turtle [1763]	Endangered	Foraging, feeding or related behaviour known to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Foraging, feeding or related behaviour known to occur within area
Disteira kingii Spectacled Seasnake [1123]		Species or species habitat may occur within area

Name	Threatened	Type of Presence
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
Natator depressus Flatback Turtle [59257]	Vulnerable	Foraging, feeding or related behaviour 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 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
Berardius arnuxii Arnoux's Beaked Whale [70]		Species or species habitat may occur within area
Caperea marginata Pygmy Right Whale [39]		Foraging, feeding or related behaviour may 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	Breeding known to 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
Globicephala melas Long-finned Pilot Whale [59282]		Species or species habitat may occur within area
Grampus griseus Risso's Dolphin, Grampus [64]		Species or species habitat may occur within

Name	Status	Type of Presence
		area
Hyperoodon planifrons Southern Bottlenose Whale [71]		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
Lagenorhynchus obscurus Dusky Dolphin [43]		Species or species habitat likely to occur within area
Lissodelphis peronii Southern Right Whale Dolphin [44]		Species or species habitat may occur within area
Megaptera novaeangliae Humpback Whale [38]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Mesoplodon bowdoini Andrew's Beaked Whale [73]		Species or species habitat may occur within area
Mesoplodon densirostris Blainville's Beaked Whale, Dense-beaked Whale [74]		Species or species habitat may occur within area
Mesoplodon ginkgodens Gingko-toothed Beaked Whale, Gingko-toothed Whale, Gingko Beaked Whale [59564]		Species or species habitat may occur within area
Mesoplodon grayi Gray's Beaked Whale, Scamperdown Whale [75]		Species or species habitat may occur within area
Mesoplodon hectori Hector's Beaked Whale [76]		Species or species habitat may occur within area
Mesoplodon layardii Strap-toothed Beaked Whale, Strap-toothed Whale, Layard's Beaked Whale [25556]		Species or species habitat may occur within area
Mesoplodon mirus True's Beaked Whale [54]		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]		Foraging, feeding or related behaviour known to occur within area
Pseudorca crassidens False Killer Whale [48]		Species or species habitat likely to occur within area

Name	Status	Type of Presence
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
Tasmacetus shepherdi Shepherd's Beaked Whale, Tasman Beaked Whale [55]		Species or species habitat may occur within area
Tursiops aduncus Indian Ocean Bottlenose Dolphin, Spotted Bottlenose Dolphin [68418]		Species or species habitat likely to occur within area
Tursiops 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
Abrolhos	Habitat Protection Zone (IUCN IV)
Abrolhos	Multiple Use Zone (IUCN VI)
Abrolhos	Special Purpose Zone (IUCN VI)
Bremer	National Park Zone (IUCN II)
Bremer	Special Purpose Zone (Mining
Eastern Recherche	National Park Zone (IUCN II)
Eastern Recherche	Special Purpose Zone (IUCN VI)
Geographe	Habitat Protection Zone (IUCN IV)
Geographe	Multiple Use Zone (IUCN VI)
Geographe	National Park Zone (IUCN II)
Geographe	Special Purpose Zone (Mining
Great Australian Bight	Special Purpose Zone (Mining
Jurien	Special Purpose Zone (IUCN VI)
South-west Corner	Habitat Protection Zone (IUCN IV)
South-west Corner	Multiple Use Zone (IUCN VI)
South-west Corner	National Park Zone (IUCN II)
South-west Corner	Special Purpose Zone (IUCN VI)
South-west Corner	Special Purpose Zone (Mining
Twilight	National Park Zone (IUCN II)
Twilight	Special Purpose Zone (Mining
Two Rocks	Multiple Use Zone (IUCN VI)

Extra Information

State and Territory Reserves [Resource Information]

Name	State
Bald Island	WA
Boullanger, Whitlock, Favourite, Tern And Osprey Islands	WA
Eclipse Island	WA
Escape Island	WA
Flinders Bay	WA
Penguin Island	WA
Recherche Archipelago	WA
St Alouarn Island	WA
Unnamed WA44682	WA
Unnamed WA48968	WA

Invasive Species [Resource Information]

Weeds reported here are the 20 species of national significance (WoNS), along with other introduced plants that are considered by the States and Territories to pose a particularly significant threat to biodiversity. The following feral animals are reported: Goat, Red Fox, Cat, Rabbit, Pig, Water Buffalo and Cane Toad. Maps from Landscape Health Project, National Land and Water Resouces Audit, 2001.

Name	Status	Type of Presence
Birds		
Acridotheres tristis Common Myna, Indian Myna [387]		Species or species habitat likely to occur within area
Anas platyrhynchos Mallard [974]		Species or species habitat likely to occur within area
Carduelis carduelis European Goldfinch [403]		Species or species habitat likely to occur within area
Columba livia Rock Pigeon, Rock Dove, Domestic Pigeon [803]		Species or species habitat likely to occur within area
Passer domesticus House Sparrow [405]		Species or species habitat likely to occur within area
Passer montanus Eurasian Tree Sparrow [406]		Species or species habitat likely to occur within area
Streptopelia chinensis Spotted Turtle-Dove [780]		Species or species habitat likely to occur within area
Streptopelia senegalensis Laughing Turtle-dove, Laughing Dove [781]		Species or species habitat likely to occur within area
Sturnus vulgaris Common Starling [389]		Species or species habitat likely to occur within area
Turdus merula Common Blackbird, Eurasian Blackbird [596]		Species or species habitat likely to occur within area
Mammals		
Bos taurus Domestic Cattle [16]		Species or species habitat likely to occur within area

Name	Status	Type of Presence
Canis lupus familiaris Domestic Dog [82654]		Species or species habitat likely to occur within area
Felis catus Cat, House Cat, Domestic Cat [19]		Species or species habitat likely to occur within area
Feral deer Feral deer species in Australia [85733]		Species or species habitat likely to occur within area
Funambulus pennantii Northern Palm Squirrel, Five-striped Palm Squirrel [129]		Species or species habitat likely to occur within area
Mus musculus House Mouse [120]		Species or species habitat likely to occur within area
Oryctolagus cuniculus Rabbit, European Rabbit [128]		Species or species habitat likely to occur within area
Rattus norvegicus Brown Rat, Norway Rat [83]		Species or species habitat likely to occur within area
Rattus rattus Black Rat, Ship Rat [84]		Species or species habitat likely to occur within area
Sus scrofa Pig [6]		Species or species habitat likely to occur within area
Vulpes vulpes Red Fox, Fox [18]		Species or species habitat likely to occur within area
Plants		
Anredera cordifolia Madeira Vine, Jalap, Lamb's-tail, Mignonette Vine, Anredera, Gulf Madeiravine, Heartleaf Madeiravine, Potato Vine [2643]		Species or species habitat likely to occur within area
Asparagus aethiopicus Asparagus Fern, Ground Asparagus, Basket Fern, Sprengi's Fern, Bushy Asparagus, Emerald Asparagus [62425]		Species or species habitat likely to occur within area
Asparagus asparagoides Bridal Creeper, Bridal Veil Creeper, Smilax, Florist's Smilax, Smilax Asparagus [22473]		Species or species habitat likely to occur within area
Asparagus plumosus Climbing Asparagus-fern [48993]		Species or species habitat likely to occur within area
Brachiaria mutica Para Grass [5879]		Species or species habitat may occur within area
Cenchrus ciliaris Buffel-grass, Black Buffel-grass [20213]		Species or species habitat may occur within area
Chrysanthemoides monilifera Bitou Bush, Boneseed [18983]		Species or species habitat may occur within area
Chrysanthemoides monilifera subsp. monilifera Boneseed [16905]		Species or species habitat likely to occur within area

Name	Status	Type of Presence
Genista linifolia Flax-leaved Broom, Mediterranean Broom, Flax Broom [2800]		Species or species habitat likely to occur within area
Genista sp. X Genista monspessulana Broom [67538]		Species or species habitat may occur within area
Lantana camara Lantana, Common Lantana, Kamara Lantana, Large-leaf Lantana, Pink Flowered Lantana, Red Flowered Lantana, Red-Flowered Sage, White Sage, Wild Sage [10892]		Species or species habitat likely to occur within area
Lycium ferocissimum African Boxthorn, Boxthorn [19235]		Species or species habitat likely to occur within area
Olea europaea Olive, Common Olive [9160]		Species or species habitat may occur within area
Opuntia spp. Prickly Pears [82753]		Species or species habitat likely to occur within area
Pinus radiata Radiata Pine Monterey Pine, Insignis Pine, Wilding Pine [20780]		Species or species habitat may occur within area
Rubus fruticosus aggregate Blackberry, European Blackberry [68406]		Species or species habitat likely to occur within area
Sagittaria platyphylla Delta Arrowhead, Arrowhead, Slender Arrowhead [68483]		Species or species habitat likely to occur within area
Salix spp. except S.babylonica, S.x calodendron & S.x reichardtii Willows except Weeping Willow, Pussy Willow and Sterile Pussy Willow [68497]		Species or species habitat likely to occur within area
Salvinia molesta Salvinia, Giant Salvinia, Aquarium Watermoss, Kariba Weed [13665]		Species or species habitat likely to occur within area
Tamarix aphylla Athel Pine, Athel Tree, Tamarisk, Athel Tamarisk, Athel Tamarix, Desert Tamarisk, Flowering Cypress, Salt Cedar [16018]		Species or species habitat likely to occur within area
Reptiles		
Hemidactylus frenatus Asian House Gecko [1708]		Species or species habitat likely to occur within area

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 90-120m depth	South-west
Commonwealth marine environment surrounding	South-west
Commonwealth marine environment within and	South-west
Commonwealth marine environment within and	South-west
Diamantina Fracture Zone	South-west
Naturaliste Plateau	South-west
Western demersal slope and associated fish	South-west
Western rock lobster	South-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

-25.765206 109.237891,-25.725623 109.501563,-25.992551 109.732276,-25.992551 109.875098,-26.071525 110.182716,-26.229314 110.325538,-25.656321 112.127296,-27.717513 112.984229,-27.814726 114.02793,-28.202708 114.159766,-28.483117 114.445411,-28.695347 114.577247,-28.974447 114.599219,-29.147305 114.818946,-29.530391 114.950782,-29.921554 114.89585,-30.746498 115.082618,-31.517621 115.533057,-31.863505 115.730811,-32.523601 115.67588,-32.634692 115.544044,-33.16049 115.620948,-33.619137 115.302344,-33.49096 114.994727,-33.737988 114.928809,-34.275319 114.972755,-34.46575 115.126563,-34.366055 115.269385,-34.818257 115.917579,-34.908402 116.060401,-35.106373 116.598731,-35.11536 117.389747,-35.169263 117.774268,-35.169263 118.081885,-34.980447 118.312598,-34.402321 119.663917,-34.30255 119.56504,-34.029844 119.883643,-33.938746 120.960303,-33.911398 121.399757,-34.011632 121.949073,-34.102652 122.476417,-34.038948 123.432227,-33.591687 124.091407,-33.10529 124.212257,-32.902593 125.014258,-32.319576 126.134864,-32.375265 127.123633,-31.760809 129.035255,-35.294897 129.068214,-35.634921 127.541114,-37.453004 125.157081,-37.696807 123.058692,-37.688114 120.817481,-38.46644 118.664161,-38.337294 115.697852,-37.418109 113.368751,-36.584603 112.028419,-34.998448 111.061622,-33.545916 110.973731,-31.984725 111.512061,-31.414542 111.270362,-30.026241 110.182716,-28.396173 109.798194,-27.756409 109.875098,-25.765206 109.237891,-25.765206 109.237891

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 B. SUPPORTING FIGURES FOR SECTION 2.3 METEOROLOGY AND OCEANOGRAPHY

Browse

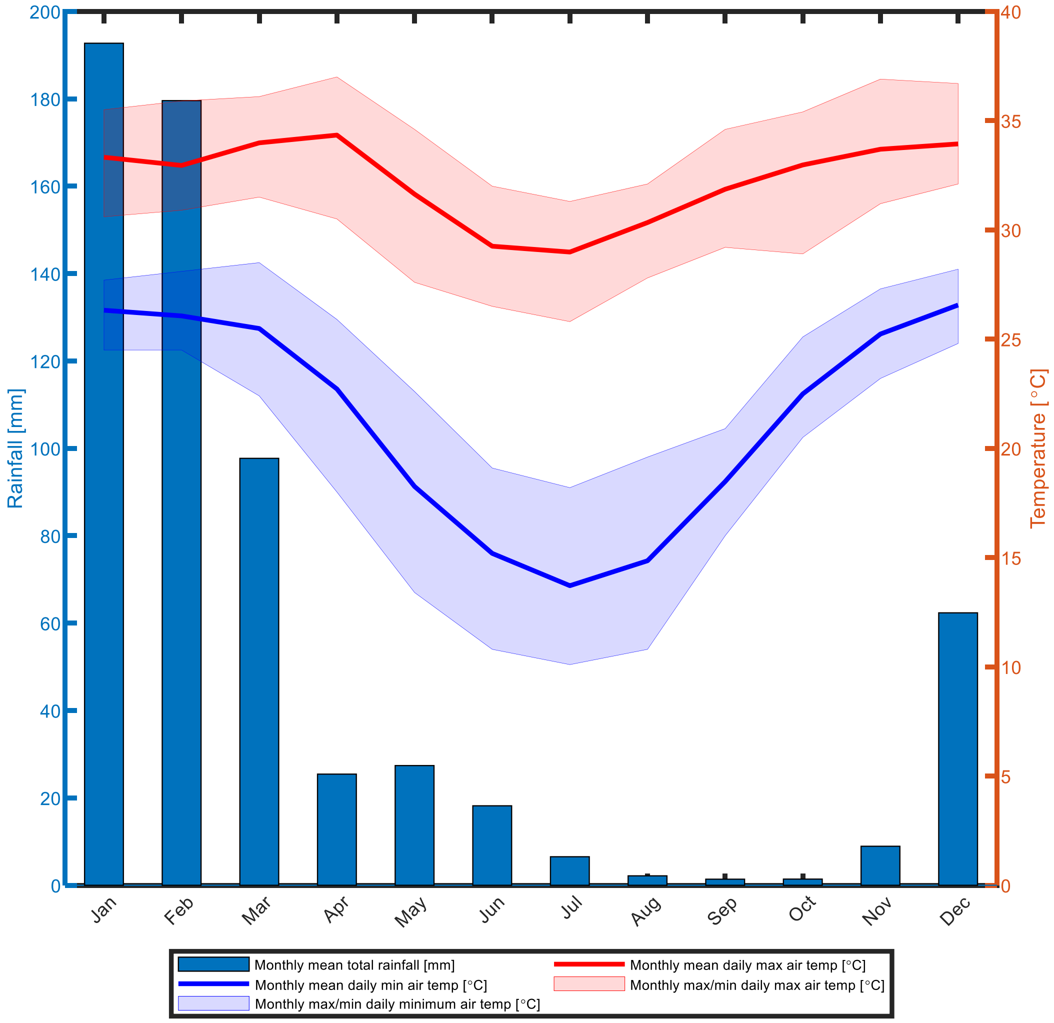

Figure 1. Monthly average total rainfall [mm] and air temperature [°C], calculated based on observations at the Broome Airport weather station from 1939-2020 (Bureau of Meteorology 2020). Bars show the monthly average total rainfall values, and thick blue and red lines denote monthly average daily minimum and maximum air temperatures, respectively. Shaded blue and red areas denote monthly recorded extremes of daily minimum and maximum air temperature, respectively.

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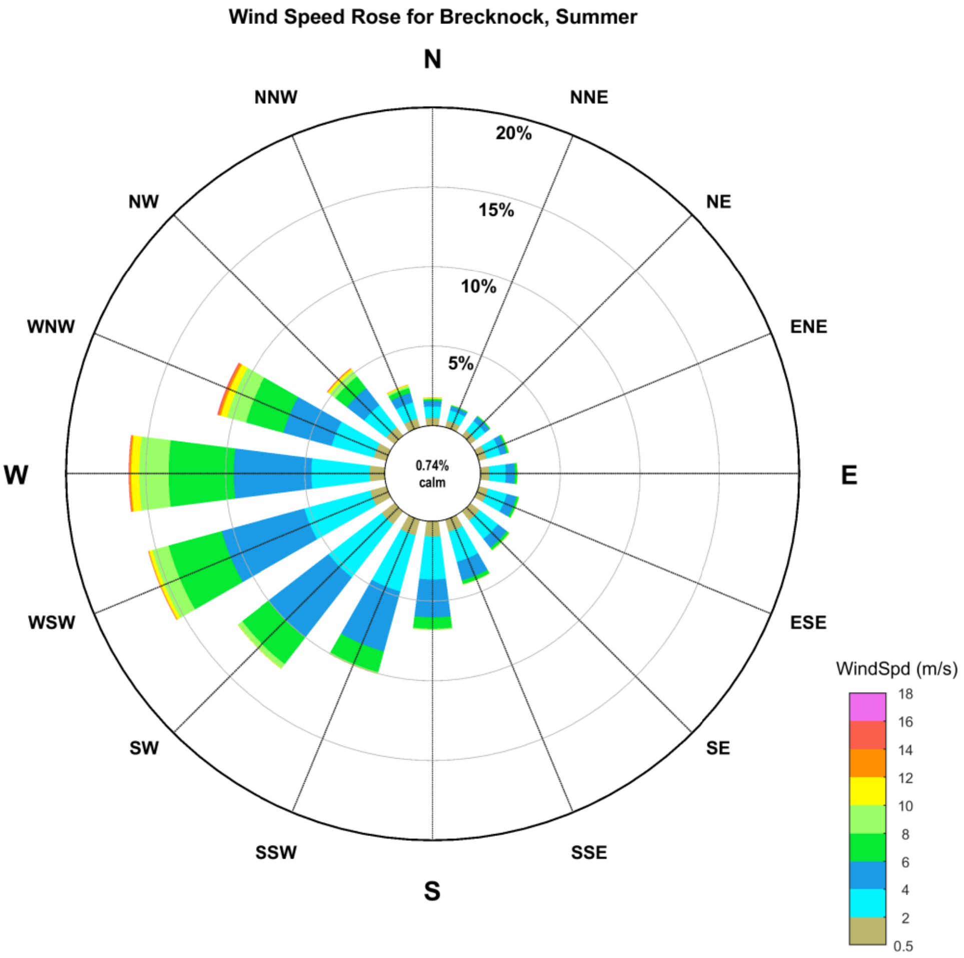

Data Information:
Project: Browse
Location: Brecknock [121.6500^{o}E, 14.5300^{o}S]
Data Period: Summer (01-Jan-1979 to 01-Jan-2019)
Data Source: Modelled Hindcast
Record Elevation: 10 m AMSL
Local Water Depth (m): 560
Data Summary: Summer
Number of Records: 164812
Missing Data (%): 5.80
Calm (% < 0.50m/s): 0.74
Measurement Format: 10-minute avg.

Key Statistics for Data Shown:
Max Wind Speed: 20.60 m/s
Mean Wind Speed: 4.55 m/s
StdDev. Wind Speed: 2.31 m/s

Woodside

Figure 2. Summer distributions of 10-minute average wind speeds by 22.5° directional sectors at the Brecknock site (Metocean Solutions Ltd, 2019). Note tropical cyclone events were not included in this distribution. Winds at Brecknock in summer are predominantly from the WNW to SW due to the North West Monsoon (WEL, 2019).

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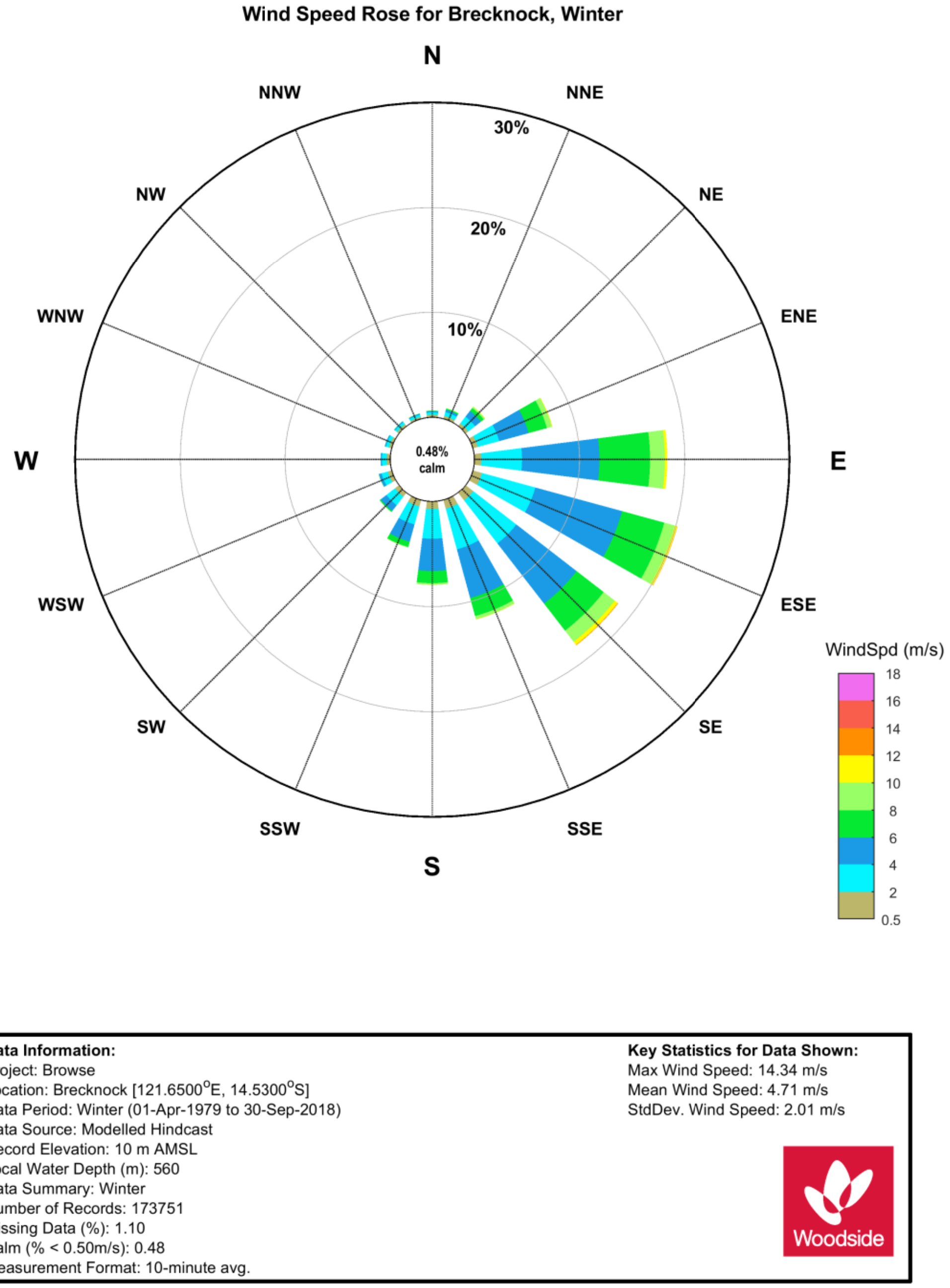

Data Information:
Project: Browse
Location: Brecknock [121.6500°E, 14.5300°S]
Data Period: Winter (01-Apr-1979 to 30-Sep-2018)
Data Source: Modelled Hindcast
Record Elevation: 10 m AMSL
Local Water Depth (m): 560
Data Summary: Winter
Number of Records: 173751
Missing Data (%): 1.10
Calm (% < 0.50m/s): 0.48
Measurement Format: 10-minute avg.

Key Statistics for Data Shown:
Max Wind Speed: 14.34 m/s
Mean Wind Speed: 4.71 m/s
StdDev. Wind Speed: 2.01 m/s

Figure 3. Winter distributions of 10-minute average wind speeds by 22.5° directional sectors at the Brecknock site (Metocean Solutions Ltd, 2019). Note tropical cyclone events were not included in this distribution. Winds at Brecknock in winter are predominantly from the E to SE due to the South East Trade Winds coming from the Australian mainland (WEL, 2019).

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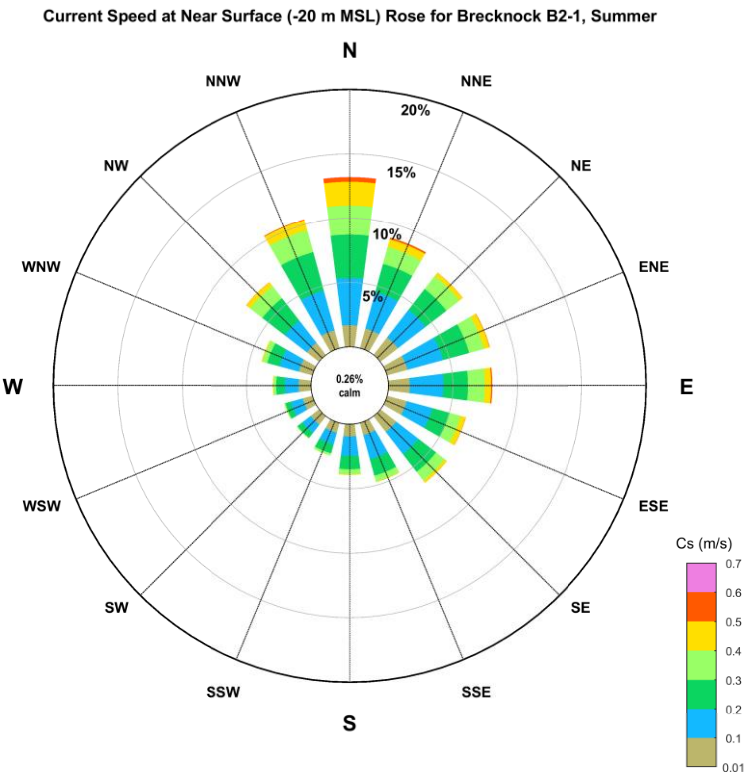

Data Information:
Project: Browse
Location: Brecknock B2-1 [121.5700°E, 14.5100°S]
Data Period: Summer (01-Oct-2006 to 31-Mar-2007)
Data Source: CM04 Measured
Record Elevation: Near Surface (-20 m MSL)
Local Water Depth (m): 560
Data Summary: Summer
Number of Records: 243472
Missing Data (%): 7.10
Calm (% < 0.01m/s): 0.26

Key Statistics for Data Shown:
Max Curr Spd: 0.63 m/s
Mean Curr Spd: 0.20 m/s
StdDev. Curr Spd: 0.11 m/s

Figure 4. Summer (Nov-Apr) near surface combined frequency of 1-minute mean current speed and direction (towards) measured at Brecknock B2-1 location (cyclones removed) (RPS Metocean Ltd. 2008).

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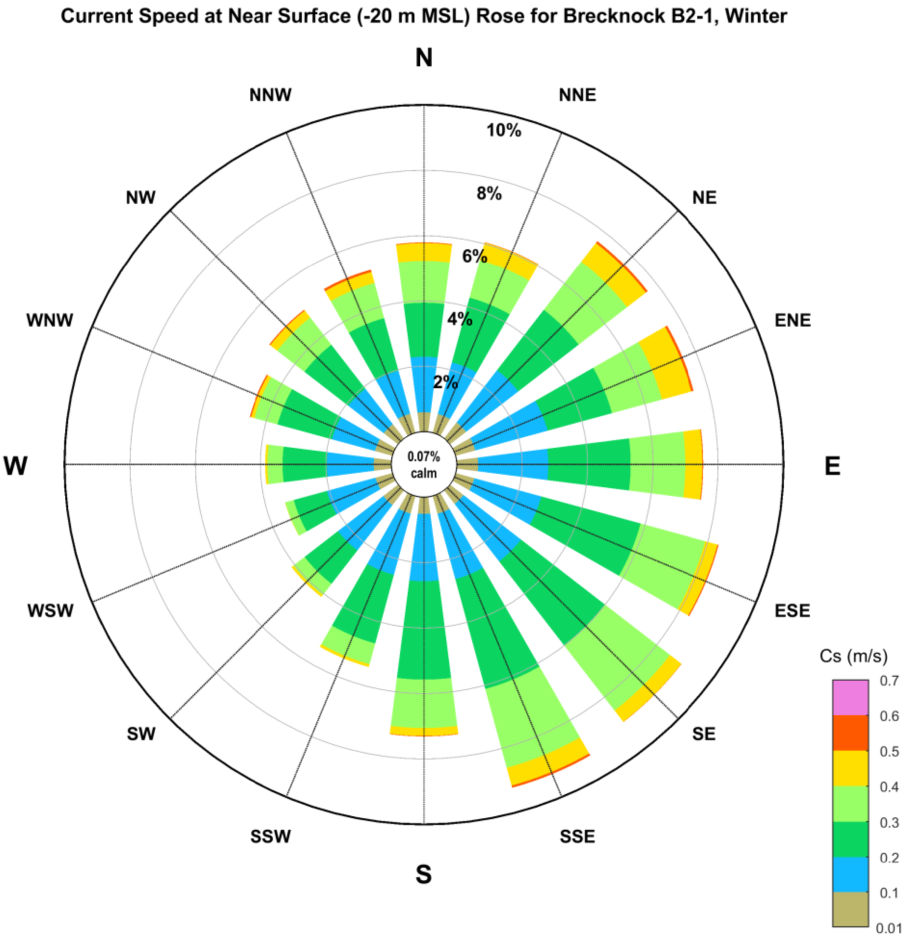

Data Information:
Project: Browse
Location: Brecknock B2-1 [121.5700°E, 14.5100°S]
Data Period: Winter (17-Sep-2006 to 08-Sep-2007)
Data Source: CM04 Measured
Record Elevation: Near Surface (-20 m MSL)
Local Water Depth (m): 560
Data Summary: Winter
Number of Records: 246184
Missing Data (%): 1.46
Calm (% < 0.01m/s): 0.07

Key Statistics for Data Shown:
Max Curr Spd: 0.62 m/s
Mean Curr Spd: 0.24 m/s
StdDev. Curr Spd: 0.10 m/s

Figure 5. Winter (May-Sep) near surface combined frequency of 1-minute mean current speed and direction (towards) measured at Brecknock B2-1 location (cyclones removed) (RPS Metocean Ltd. 2008).

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North-west Shelf/Scarborough

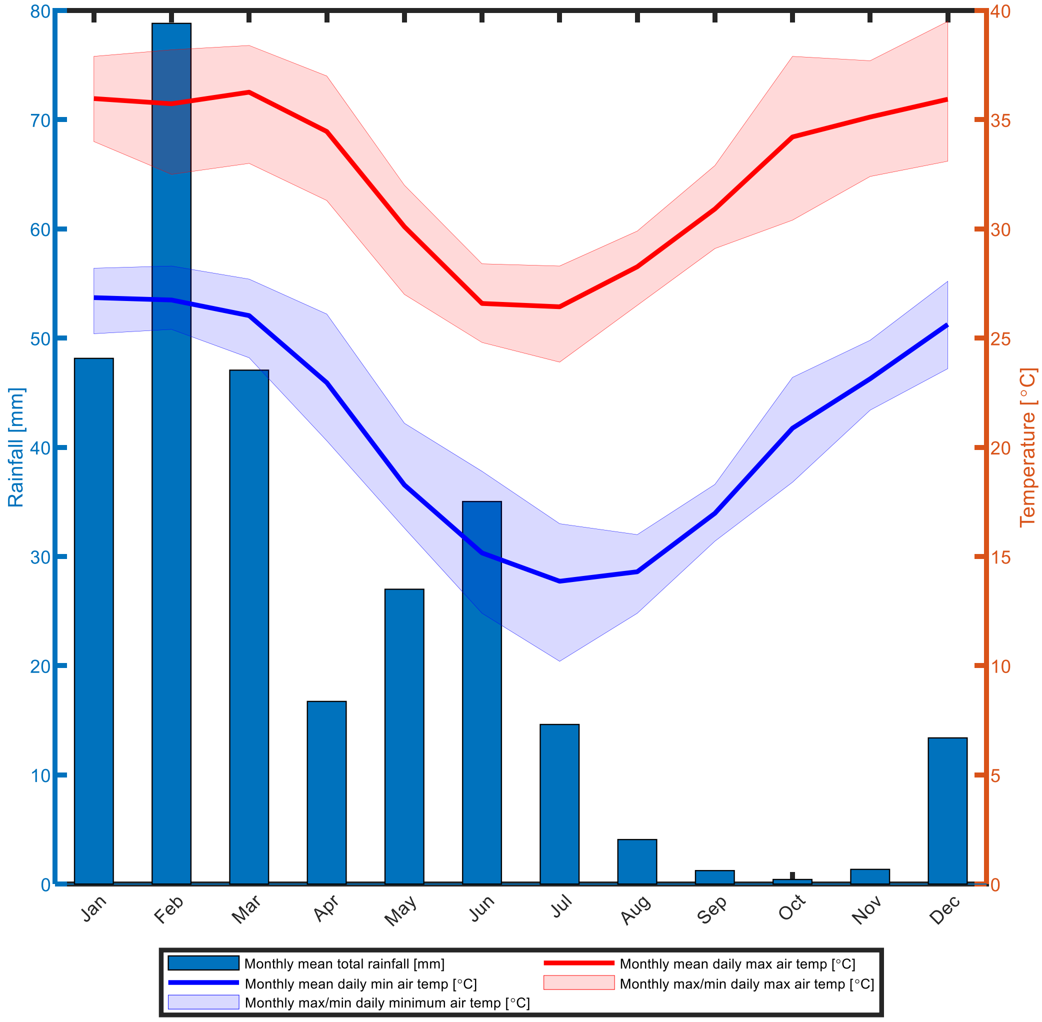

Figure 1. Monthly average total rainfall [mm] and air temperature [°C], calculated based on observations at the Karratha Aero weather station from 1972-2020 and 1993-2020 respectively (Bureau of Meteorology 2020). Bars show the monthly average total rainfall values, and thick blue and red lines denote monthly average daily minimum and maximum air temperatures, respectively. Shaded blue and red areas denote monthly recorded extremes of daily minimum and maximum air temperature, respectively.

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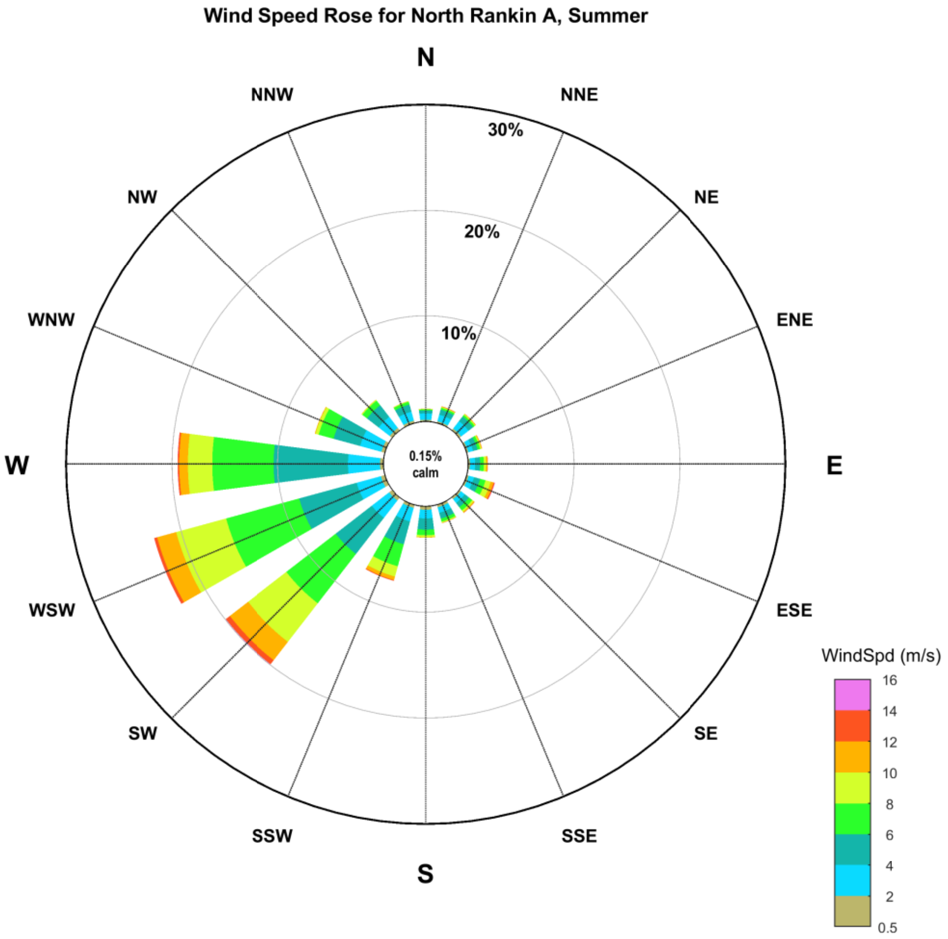

Data Information:
Project: North West Shelf
Location: North Rankin A [116.1200^{o}E, 19.6100^{o}S]
Data Period: Summer (01-Oct-1995 to 30-Nov-2015)
Data Source: Measured Winds
Record Elevation: 10 m AMSL
Local Water Depth (m): 125
Data Summary: Summer
Number of Records: 674659
Missing Data (%): 7.24
Calm (% < 0.50m/s): 0.15
Measurement Format: 10-minute avg.

Key Statistics for Data Shown:
Max Wind Speed: 18.50 m/s
Mean Wind Speed: 6.04 m/s
StdDev. Wind Speed: 2.55 m/s

Woodside

Figure 2. Summer distributions of 10-minute average wind speeds by 22.5° directional sectors at the North Rankin A site (WEL, 2015). Note tropical cyclone events were not included in this distribution. Winds at North Rankin A in summer are characterised by W to SW driven by the North West Monsoon (RPS, 2016).

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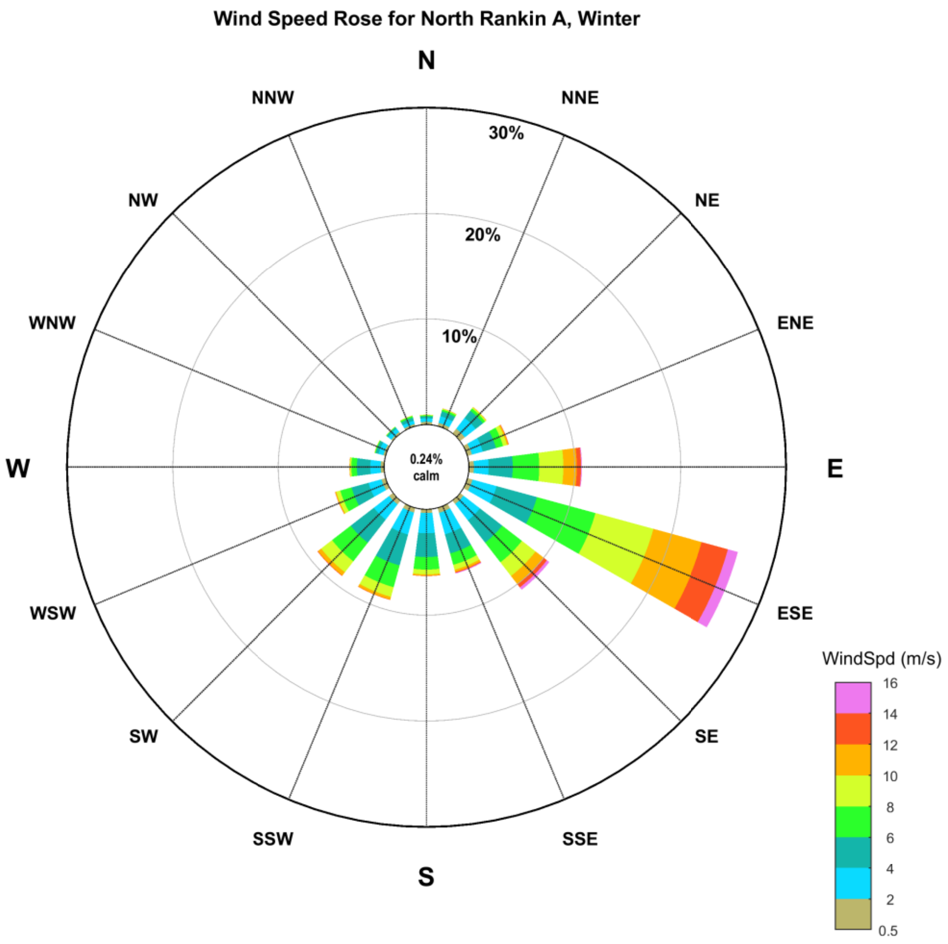

Data Information:
Project: North West Shelf
Location: North Rankin A [116.1200°E, 19.6100°S]
Data Period: Winter (22-Jun-1995 to 30-Sep-2015)
Data Source: Measured Winds
Record Elevation: 10 m AMSL
Local Water Depth (m): 125
Data Summary: Winter
Number of Records: 673213
Missing Data (%): 4.43
Calm (% < 0.50m/s): 0.24
Measurement Format: 10-minute avg.

Key Statistics for Data Shown:
Max Wind Speed: 24.23 m/s
Mean Wind Speed: 6.25 m/s
StdDev. Wind Speed: 3.16 m/s

Woodside

Figure 3. Winter distributions of 10-minute average wind speeds by 22.5° directional sectors at the North Rankin A site (WEL, 2015). Note tropical cyclone events were not included in this distribution. Winds at North Rankin in winter are predominantly influenced by the South East Trade Winds over Australia (RPS, 2016).

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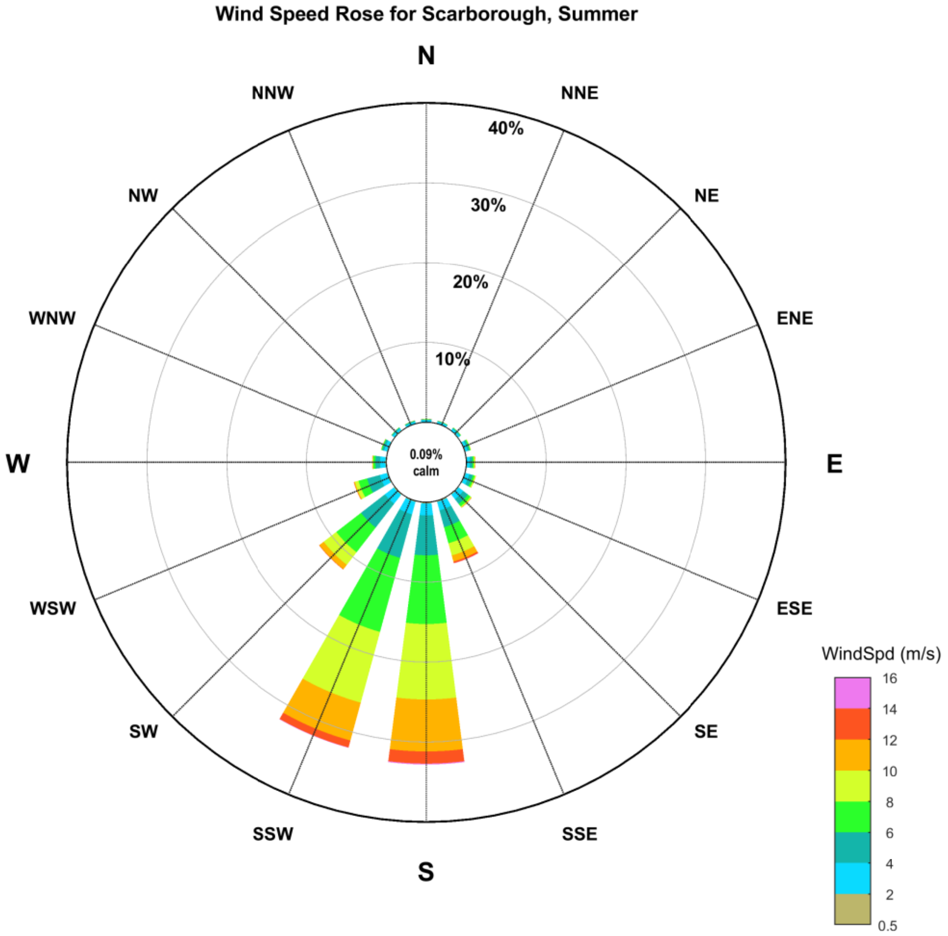
Scarborough



Data Information:
Project: North West Shelf
Location: Scarborough [113.2000°E, 19.8800°S]
Data Period: Summer (01-Jan-1979 to 01-Jan-2011)
Data Source: CSFR
Record Elevation: 10 m AMSL
Local Water Depth (m): 950
Data Summary: Summer
Number of Records: 129521
Missing Data (%): 7.46
Calm (% < 0.50m/s): 0.09
Measurement Format: 10-minute avg.

Key Statistics for Data Shown:
Max Wind Speed: 16.75 m/s
Mean Wind Speed: 7.23 m/s
StdDev. Wind Speed: 2.64 m/s

Figure 4. Summer distributions of wind speeds (10-minute at 10m ASL) by 22.5° directional sectors at the Scarborough site (WEL, 2018). Note tropical cyclone events were not included in this distribution. Winds at Scarborough in summer are predominantly from the S to SSW due to a Pilbara Heat Low forming over the northwest coast of Western Australia [R8] SW winds are also experienced at this site due to the monsoon trough.

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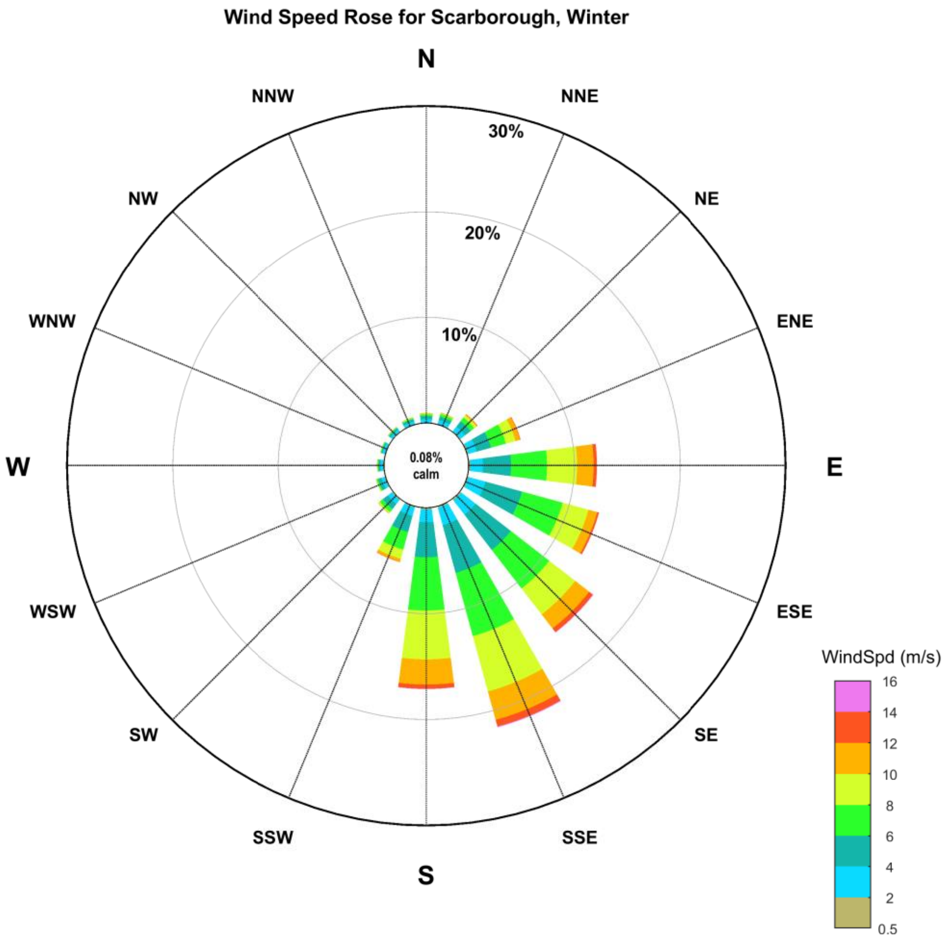

Data Information:
Project: North West Shelf
Location: Scarborough [113.2000°E, 19.8800°S]
Data Period: Winter (01-Apr-1979 to 30-Sep-2010)
Data Source: CSFR
Record Elevation: 10 m AMSL
Local Water Depth (m): 950
Data Summary: Winter
Number of Records: 138863
Missing Data (%): 1.20
Calm (% < 0.50m/s): 0.08
Measurement Format: 10-minute avg.

Key Statistics for Data Shown:
Max Wind Speed: 19.15 m/s
Mean Wind Speed: 6.90 m/s
StdDev. Wind Speed: 2.57 m/s

Woodside

Figure 5. Winter distributions of wind speeds (10-minute at 10 m ASL) by 22.5° directional sectors at the Scarborough site (WEL, 2018). Note tropical cyclone events were not included in this distribution. Winds at Scarborough in winter are predominantly from the S to E driven by the South East Trade Winds over Australia (RPS, 2016).

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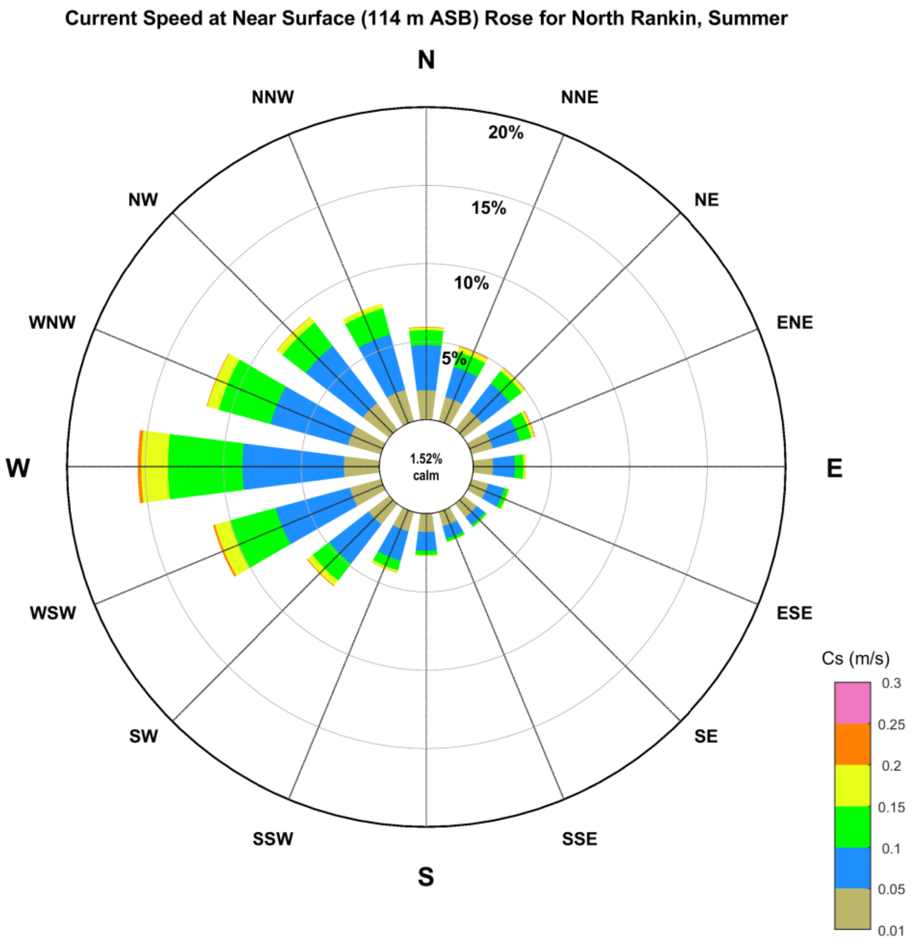
North-west Shelf



Data Information:
Project: North West Shelf
Location: North Rankin [116.1400°E, 19.5800°S]
Data Period: Summer (01-Oct-2004 to 31-Mar-2009)
Data Source: Measured Data
Record Elevation: Near Surface (114 m ASB)
Local Water Depth (m): 124.5
Data Summary: Summer
Number of Records: 496705
Missing Data (%): 6.63
Calm (% < 0.01m/s): 1.52

Key Statistics for Data Shown:
Max Curr Spd: 0.49 m/s
Mean Curr Spd: 0.08 m/s
StdDev. Curr Spd: 0.04 m/s

Figure 6. Summer (Nov-Apr) near surface combined frequency of 1-minute mean current speed and direction (towards) measured at the North Rankin location (cyclones removed) (WEL, 2011).

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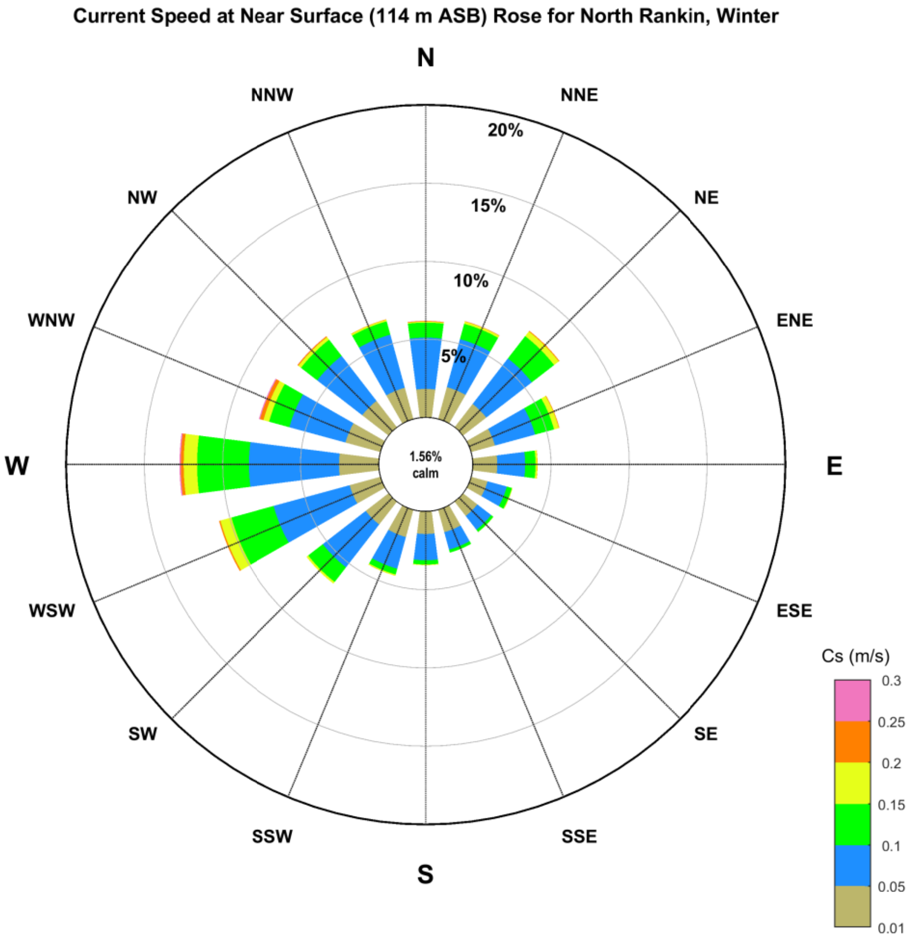
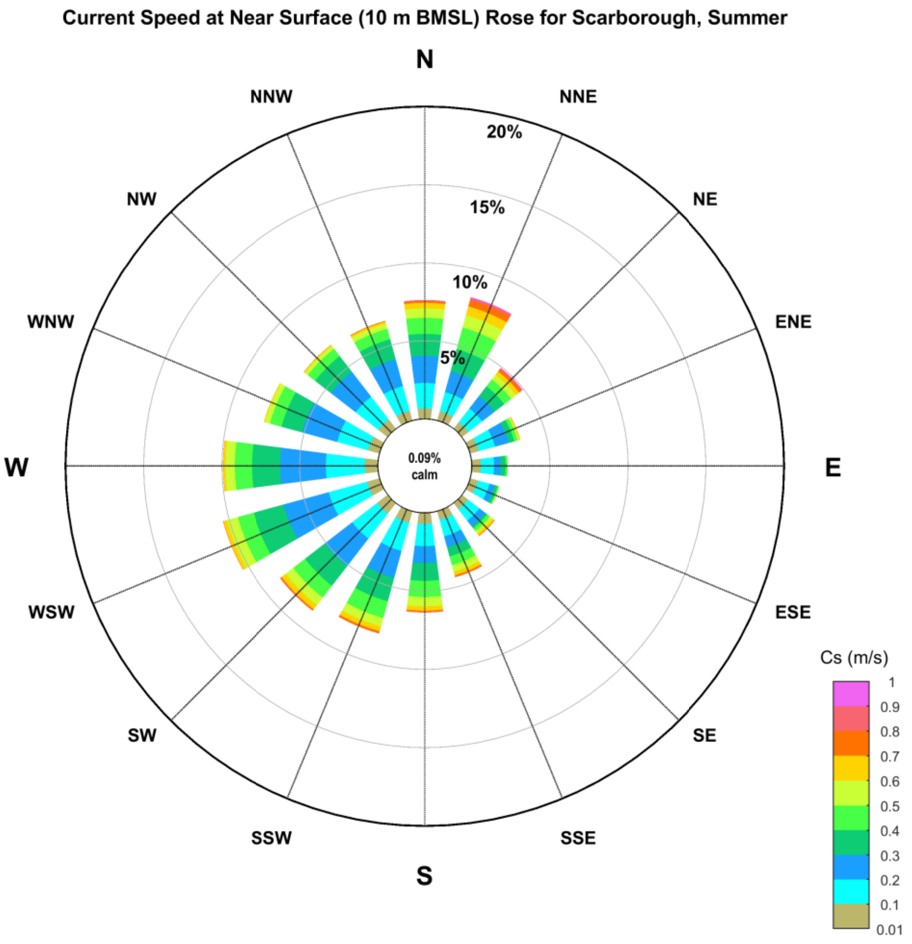


Data Information:
Project: North West Shelf
Location: North Rankin [116.1400°E, 19.5800°S]
Data Period: Winter (21-Sep-2004 to 08-May-2009)
Data Source: Measured Data
Record Elevation: Near Surface (114 m ASB)
Local Water Depth (m): 124.5
Data Summary: Winter
Number of Records: 337723
Missing Data (%): 0.88
Calm (% < 0.01m/s): 1.56

Key Statistics for Data Shown:
Max Curr Spd: 0.32 m/s
Mean Curr Spd: 0.07 m/s
StdDev. Curr Spd: 0.04 m/s

Figure 7. Winter (May-Sep) near surface combined frequency of 1-minute mean current speed and direction (towards) measured at the North Rankin location (cyclones removed) (WEL, 2011).

Scarborough



Current Speed at Near Surface (10 m BMSL) Rose for Scarborough, Summer

Data Information:
Project: North West Shelf
Location: Scarborough [113.2000°E, 19.8800°S]
Data Period: Summer (15-Jan-2010 to 29-Feb-2012)
Data Source: Measured Data
Record Elevation: Near Surface (10 m BMSL)
Local Water Depth (m): 950
Data Summary: Summer
Number of Records: 43600
Missing Data (%): 7.11
Calm (% < 0.01m/s): 0.09

Key Statistics for Data Shown:
Max Curr Spd: 1.03 m/s
Mean Curr Spd: 0.29 m/s
StdDev. Curr Spd: 0.17 m/s

Woodside

Figure 8. Summer (Nov - April) near surface combined frequency of 1-minute mean current speed and direction (towards) measured at the Scarborough location (cyclones removed) (WEL, 2018).

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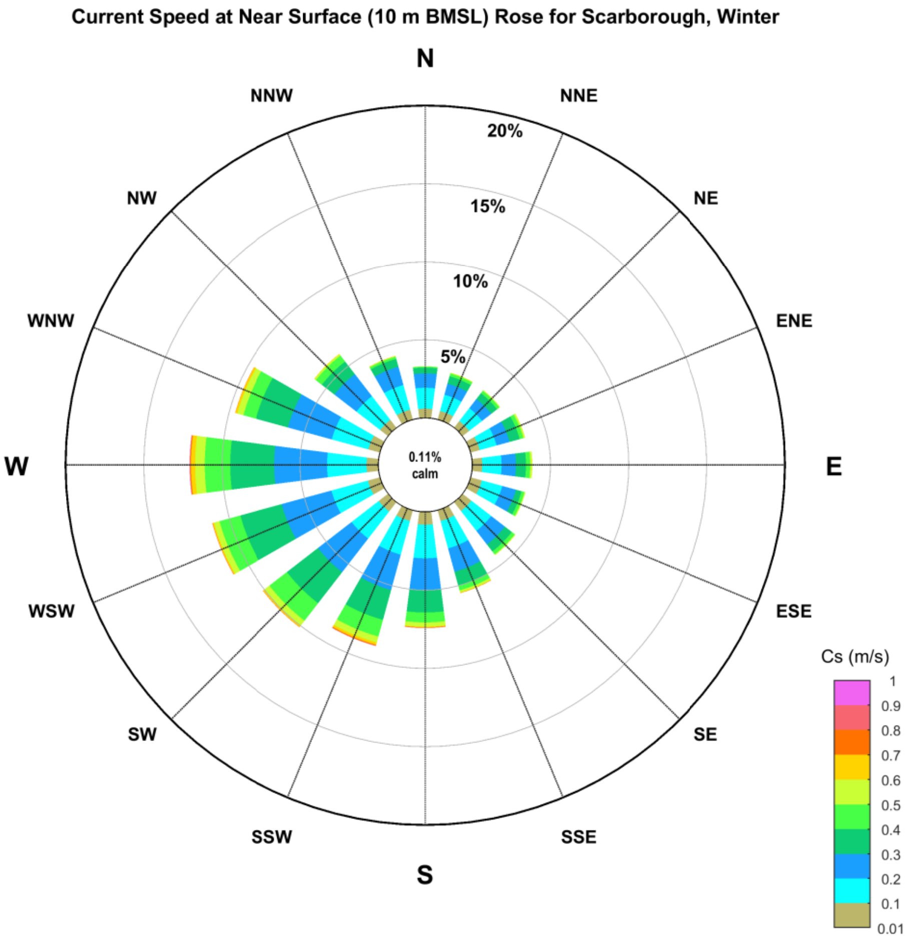

Data Information:
Project: North West Shelf
Location: Scarborough [113.2000°E, 19.8800°S]
Data Period: Winter (01-Apr-2010 to 30-Sep-2011)
Data Source: Measured Data
Record Elevation: Near Surface (10 m BMSL)
Local Water Depth (m): 950
Data Summary: Winter
Number of Records: 49345
Missing Data (%): 3.01
Calm (% < 0.01m/s): 0.11

Key Statistics for Data Shown:
Max Curr Spd: 1.03 m/s
Mean Curr Spd: 0.25 m/s
StdDev. Curr Spd: 0.13 m/s

Figure 9. Winter (May-Sep) near surface combined frequency of 1-min mean current speed and direction (towards) measured at the Scarborough location (cyclones removed) (WEL, 2018).

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North-west Cape

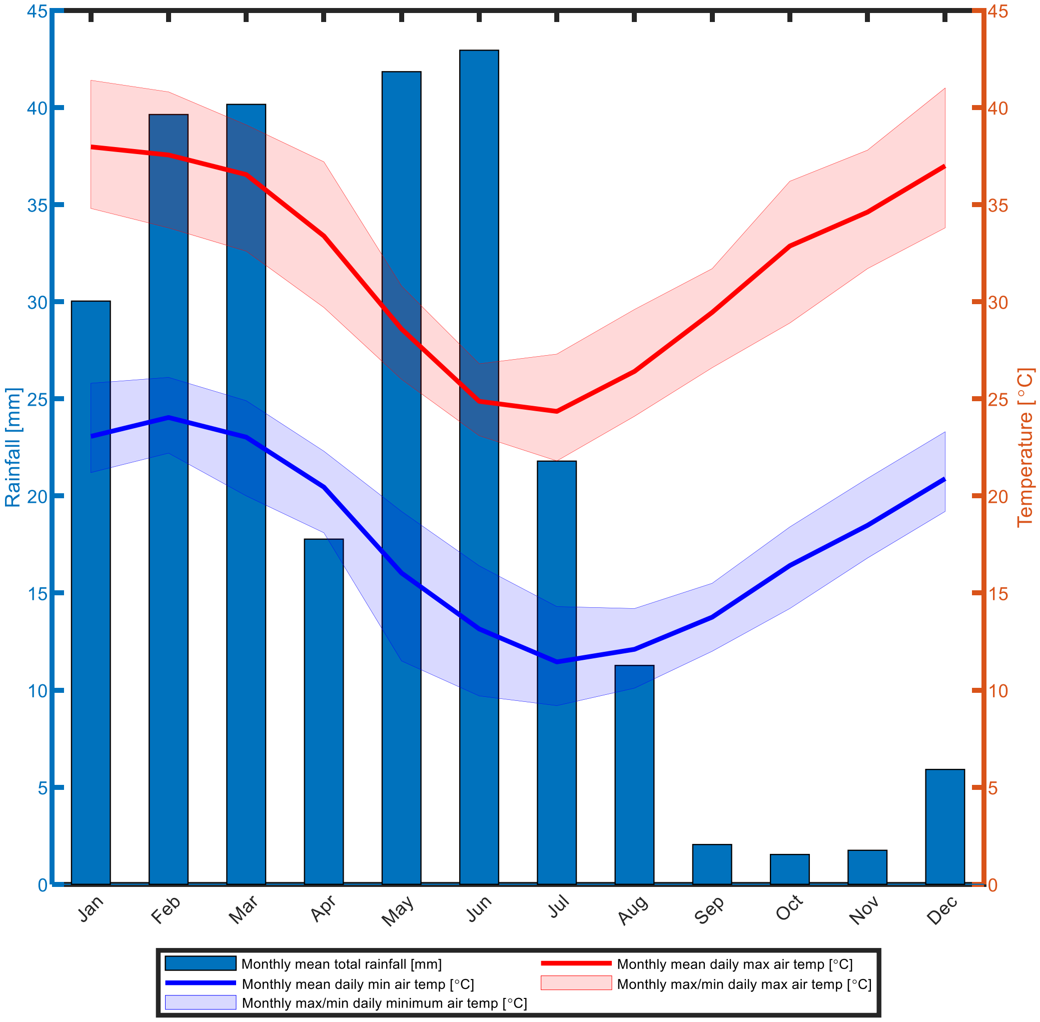

Figure 1. Monthly average total rainfall [mm] and air temperature [°C], calculated based on observations at the Learmonth Airport weather station from 1945-2020 and 1975-2020 respectively (Bureau of Meteorology 2020). Bars show the monthly average total rainfall values, and thick blue and red lines denote monthly average daily minimum and maximum air temperatures, respectively. Shaded blue and red areas denote monthly recorded extremes of daily minimum and maximum air temperature, respectively.

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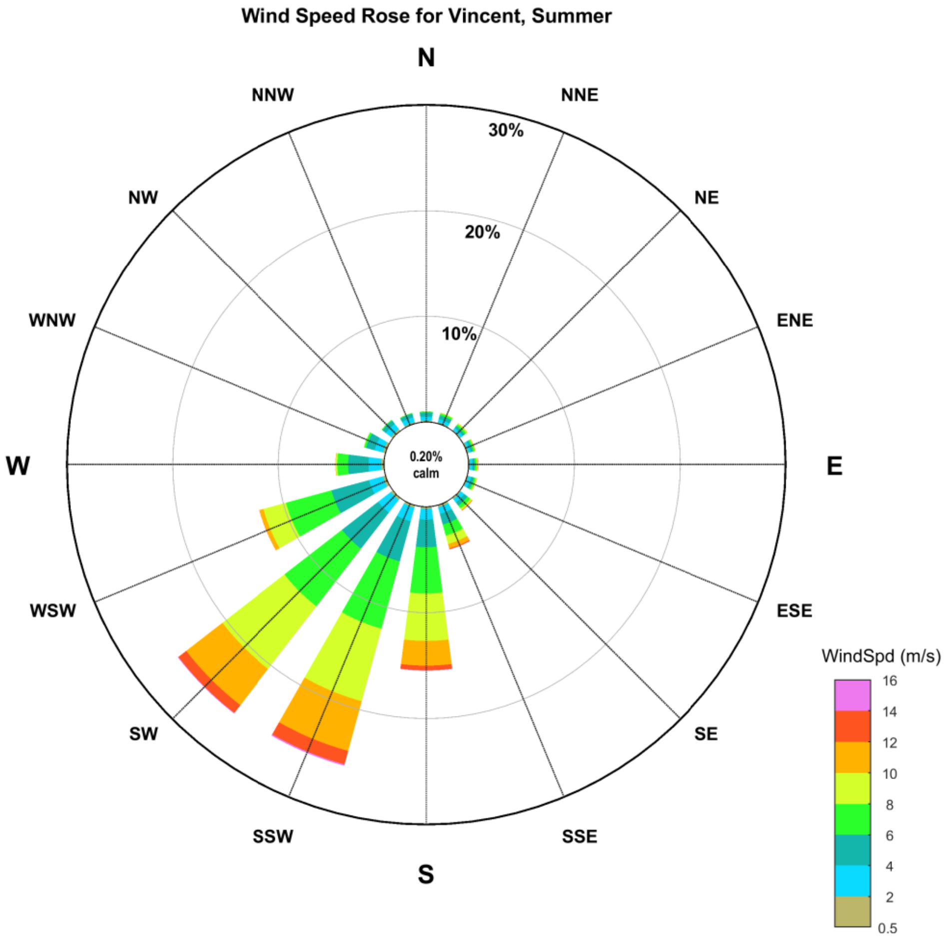

Data Information:	**Key Statistics for Data Shown:**
Project: North West Cape	Max Wind Speed: 18.86 m/s
Location: Vincent [114.0600^{o}E, 21.4400^{o}S]	Mean Wind Speed: 7.10 m/s
Data Period: Summer (01-Jan-1979 to 01-Jan-2019)	StdDev. Wind Speed: 2.75 m/s
Data Source: Modelled Hindcast	
Record Elevation: 10 m AMSL	
Local Water Depth (m): 350	
Data Summary: Summer	
Number of Records: 159379	
Missing Data (%): 8.91	
Calm (% < 0.50m/s): 0.20	
Measurement Format: 10-minute avg.	

Figure 2. Summer distributions of wind speeds (10-minute at 10 m ASL) by 22.5° directional sectors at the Vincent site (Vincent Metocean). Note tropical cyclone events were not included in this distribution. Winds at Vincent in summer are predominantly from the SW to SSW in summer due to the presence of the Pilbara Heat Low (MetOcean Engineers, 2005).

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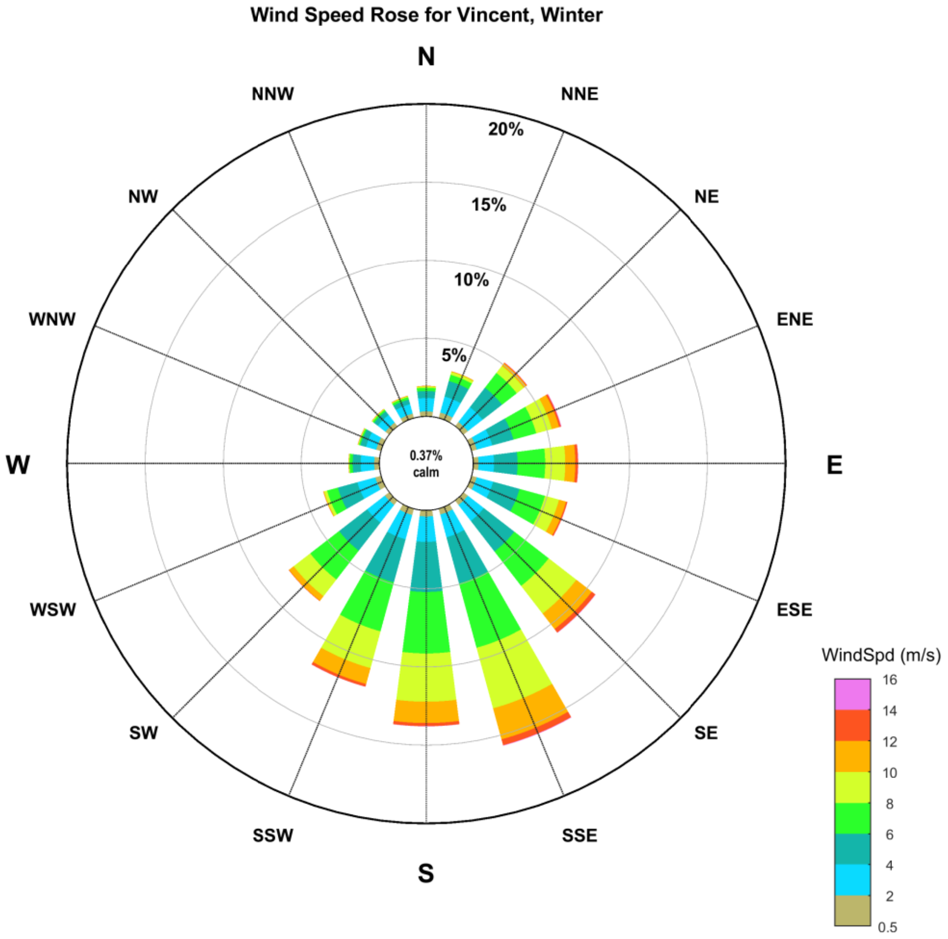
Wind Speed Rose for Vincent, Winter

Data Information:
Project: North West Cape
Location: Vincent [114.0600°E, 21.4400°S]
Data Period: Winter (01-Apr-1979 to 30-Sep-2018)
Data Source: Modelled Hindcast
Record Elevation: 10 m AMSL
Local Water Depth (m): 350
Data Summary: Winter
Number of Records: 173626
Missing Data (%): 1.17
Calm (% < 0.50m/s): 0.37
Measurement Format: 10-minute avg.

Key Statistics for Data Shown:
Max Wind Speed: 19.39 m/s
Mean Wind Speed: 6.23 m/s
StdDev. Wind Speed: 2.78 m/s

Woodside

Figure 3. Winter distributions of wind speeds (10-minute at 10 m ASL) 22.5° directional sectors at the Vincent site (Vincent Metocean). Note tropical cyclone events were not included in this distribution. In winter, winds at are predominantly from the S to SE, associated with the South East Trades. Easterly gales are experienced at the Vincent location due to high pressure systems generating from the Great Australian Bight area to the site (MetOcean Engineers, 2005).

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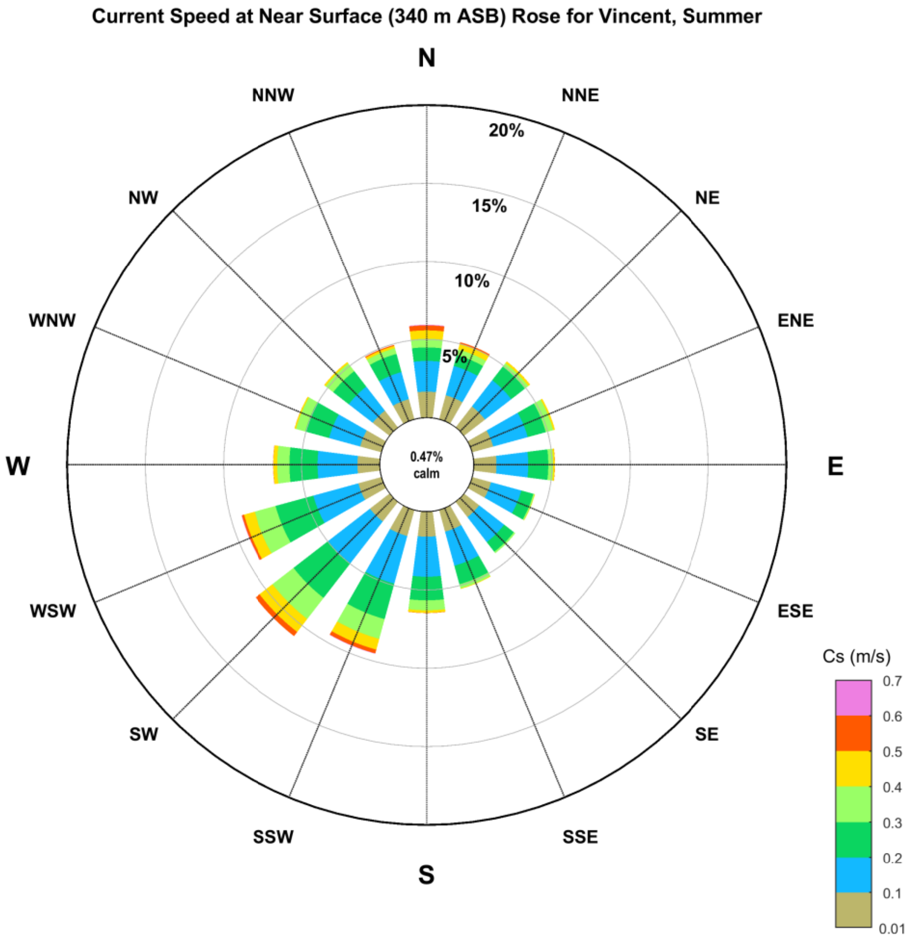

Data Information:
Project: North West Cape
Location: Vincent [114.0600^{o}E, 21.4400^{o}S]
Data Period: Summer (21-Nov-2000 to 13-Dec-2001)
Data Source: Measured Data
Record Elevation: Near Surface (340 m ASB)
Local Water Depth (m): 350
Data Summary: Summer
Number of Records: 144668
Missing Data (%): 1.59
Calm (% < 0.01m/s): 0.47

Key Statistics for Data Shown:
Max Curr Spd: 0.75 m/s
Mean Curr Spd: 0.19 m/s
StdDev. Curr Spd: 0.11 m/s

Woodside

Figure 4. Summer (May – Sep) near surface combined frequency of 1-minute mean current speed and direction (towards) measured at the Vincent location (cyclones removed) (WEL, 2016).

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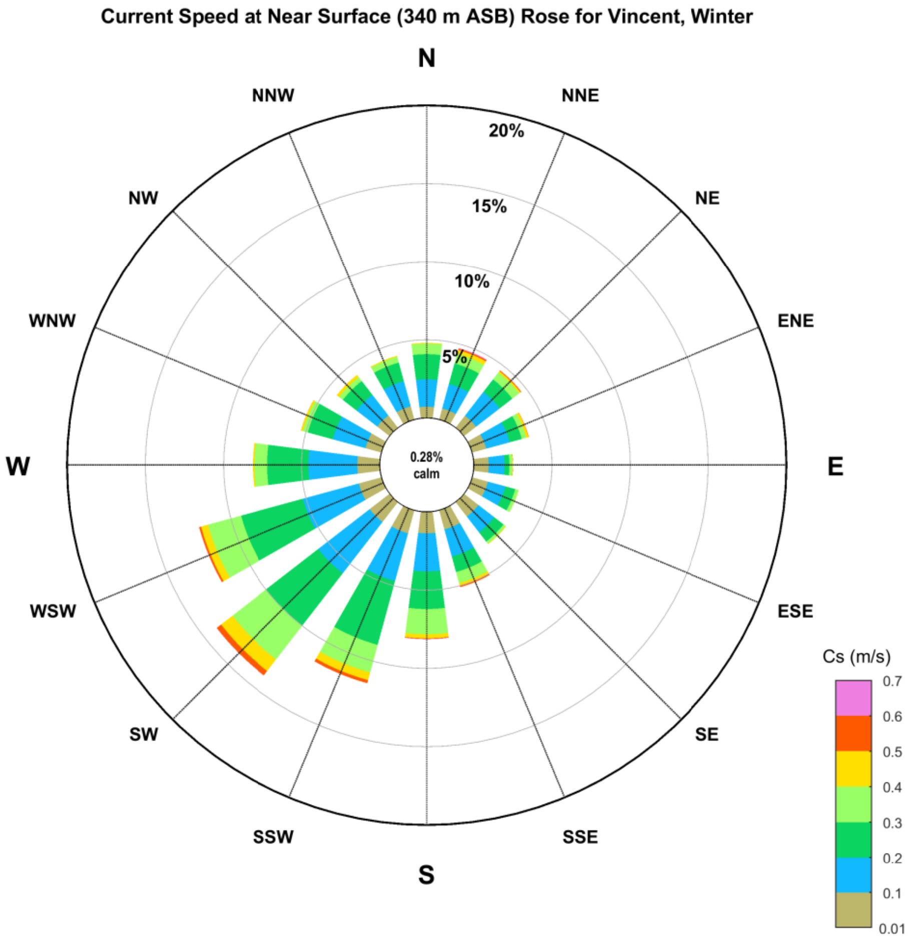

Data Information:	**Key Statistics for Data Shown:**
Project: North West Cape	Max Curr Spd: 0.64 m/s
Location: Vincent [114.0600^{o}E, 21.4400^{o}S]	Mean Curr Spd: 0.20 m/s
Data Period: Winter (01-Apr-2001 to 30-Sep-2001)	StdDev. Curr Spd: 0.11 m/s
Data Source: Measured Data	
Record Elevation: Near Surface (340 m ASB)	
Local Water Depth (m): 350	
Data Summary: Winter	
Number of Records: 126313	
Missing Data (%): 4.13	
Calm (% < 0.01m/s): 0.28	

Figure 5. Winter (Nov – Apr) near surface combined frequency of 1-minute mean current speed and direction (towards) measured at the Vincent location (cyclones removed) (WEL, 2016).

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APPENDIX I FIRST STRIKE PLAN

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Balnaves Plug and Abandonment Oil Pollution First Strike Plan

Security & Emergency Management
Hydrocarbon Spill Preparedness

November 2021
Revision: 0a

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BALNAVES PLUG AND ABANDONMENT OIL POLLUTION FIRST STRIKE PLAN

SPILL FROM FACILITY INCLUDING SUBSEA INFRASTRUCTURE

LEVEL 1

CONTROL AGENCY: **WOODSIDE**

INCIDENT CONTROLLER: **Person In Charge (PIC) with support from Onshore Team Leader (OTL)**

LEVEL 2 & 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 & 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 & 3

CONTROL AGENCY: **AMSA**

INCIDENT CONTROLLER: **AMSA (with response assistance from Woodside)**

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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.

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). The Director General of DoT is the Hazard Management Agency (HMA) for Western Australian waters.

If the spill impacts State waters/ shorelines and is a Level 1, Woodside will remain the Control Agency. If the spill is a Level 2/3 then DoT will become the Control Agency/ HMA 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). DoT's role as the Controlling Agency/HMA 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 (July 2020):

https://www.transport.wa.gov.au/mediaFiles/marine/MAC_P_Westplan_MOP_OffshorePetroleumIndGuidance.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.

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Response Process Overview

<table>
<tr><th colspan="3">Use the below to determine actions required and which parts of this plan are relevant to the incident.</th></tr>
<tr><th colspan="3">For guidance on credible scenarios and hydrocarbon characteristics, refer to Appendix A.</th></tr>
<tr><td rowspan="2">ALL INCIDENTS</td><td colspan="2">Notify the Woodside Communication Centre (WCC) on:
[redacted]</td></tr>
<tr><td colspan="2">Incident Controller or delegate to make relevant notifications in Table 1-1 (pages 8-11) of this Oil Pollution First Strike Plan.</td></tr>
<tr><td rowspan="3">LEVEL 1</td><td>FACILITY INCIDENT</td><td>VESSEL INCIDENT</td></tr>
<tr><td>Coordinate pre-identified tactics in Table 2-1 of this Oil Pollution First Strike Plan.
Remember to download each Operational Plan.</td><td>Upon agreement with AMSA: Coordinate pre-identified tactics in Table 2-1 of this Oil Pollution First Strike Plan.
Remember to download each Operational Plan.</td></tr>
<tr><td colspan="2">If the spill escalates such that the site cannot manage the incident, inform the WCC on [redacted], [redacted] or sat phone [redacted] and escalate to a level 2/3 incident.</td></tr>
<tr><td rowspan="4">LEVEL 2/3</td><td>FACILITY INCIDENT</td><td>VESSEL INCIDENT</td></tr>
<tr><td>Handover control to CICC.</td><td>Handover control to AMSA and stand up CICC to assist.</td></tr>
<tr><td>Undertake quick revalidation of the recommended strategies on Table 3-1 taking into consideration seasonal sensitivities and current situational awareness.
Undertake validated strategies.</td><td>If requested by AMSA:
Undertake quick revalidation of the recommended strategies on Table 3-1 taking into consideration seasonal sensitivities and current situational awareness.
Undertake validated strategies.</td></tr>
<tr><td>Create an Incident Action Plan (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 Net Environmental Benefit Analysis (NEBA) see here or Appendix A of the OSPRMA</td><td>If requested by AMSA:
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 here or Appendix A of the OSPRMA</td></tr>
</table>

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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 Balnaves Plug and Abandonment 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	Offshore Installation Manager (OIM) or Vessel Master	Woodside Communication Centre (WCC)	Duty Manager	[redacted]	Verbally notify WCC of event and estimated volume and hydrocarbon type.	Verbal	
Within 2 hours	OIM or 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 NOPTA and DMIRS).	App B Form 1	
Within 3 days	OIM or WSR				Provide a written NOPSEMA Incident Report Form as soon as practicable (no later than 3 days after notification) (cc to NOPTA and DMIRS) NOPSEMA: [redacted] NOPTA: [redacted]	App B Form 2	

---

[1] Notification to NOPSEMA must be from a Woodside Representative.

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Notification timing	Responsibility	Authority /Company	Name	Contact Number	Instruction	Form/ Template	Mark Complete (✓)
					DMIRS: [redacted]		
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 standards from EP	Verbal	
As soon as practicable	CICC DM or Delegate	Department of Agriculture, Water and the Environment (Director of National Parks)	Marine Park Compliance Duty Officer	[redacted]	The Marine Park Compliance Duty Officer 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. This notification should include: • titleholder details • time and location of the incident • proposed response arrangements and locations as per the OPEP • contact details for the response coordinator.	Verbal	
Additional notifications ito be made ONLY if spill arises from Wheatstone Pipeline							
Immediately	WCC	Chevron Australia Pty Ltd (CAPL)	Chevron Perth Security Operations Centre	[redacted]	Verbally notify CAPL Security Operations Centre of event and estimated volume and hydrocarbon lost. Establish which party will be IC for spill incident.	Verbal	
Additional notifications to be made ONLY if spill is from a vessel							
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)	[redacted] [redacted] [redacted]	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							

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Notification timing	Responsibility	Authority /Company	Name	Contact Number	Instruction	Form/ Template	Mark Complete (✓)
As soon as practicable	CICC DM or Delegate	AMOSC	AMOSC Duty Manager	[redacted]	Notify AMOSC that a spill has occurred and follow-up with an email from the **IC/CICC DM, CMT 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.	App B Form 4	
As soon as practicable	CICC DM or Delegate	Oil Spill Response Limited (OSRL)	OSRL Duty Manager	[redacted]	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	[redacted]	Marine Duty Manager to verbally notify DoT that a spill has occurred and request use of equipment stored in the Karratha supply shed. 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	
As soon as practicable if there is potential for oiled wildlife or the spill is expected to	CICC DM or Delegate	WA Department of Biodiversity, Conservation and Attractions (DBCA)	Duty Officer	[redacted]	Phone call notification	Verbal	

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Notification timing	**Responsibility**	**Authority /Company**	**Name**	**Contact Number**	**Instruction**	**Form/ Template**	**Mark Complete (✓)**
contact land or waters managed by WA Department of Biodiversity, Conservation and Attractions							
As soon as practicable	CICC DM or Delegate	Marine Spill Response Corporation (MSRC)	MSRC Response Manager	[redacted]	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	

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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 Balnaves Plug and Abandonment Environment Plan Appendix D (Woodside’s Oil Spill Preparedness and Response Mitigation Assessment).

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Table 2-1: Level 1 Response Summary

Response Techniques	Hydrocarbon Type		Pre- Identified Tactics	Responsible	ALARP Commitment Summary	Complete ✓	Link to Operational Plans for notification numbers and actions
	Marine Diesel Oil	Crude					
Monitor and Evaluate (Operational Monitoring)	Yes	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 KBSB Stockpile.	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.
	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.						
	Yes	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).	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	Yes	Send Oil Spill Trajectory Modelling (OSTM) form (Appendix B Form 7) to RPS Response team ([redacted]) and call RPS Response Duty Officer Phone [redacted]	Intelligence	**DAY 1:** Detailed modelling within four hours of RPS receiving information from Woodside.		
	Yes	Yes	Instruct Aviation Duty Manager to commence aerial observations in daylight hours. Aerial surveillance observer to complete log in Appendix B Form 8.	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).

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Response Techniques	**Hydrocarbon Type**		**Pre- Identified Tactics**	**Responsible**	**ALARP Commitment Summary**	**Complete ✓**	**Link to Operational Plans for notification numbers and actions**
	Marine Diesel Oil	**Crude**					
	Yes	Yes	The Intelligence duty manager should be instructed to stand up KSAT to provide satellite imagery of the spill. [redacted]	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.		*Planning to download immediately and follow steps*
	Yes	Yes	Consider the need to mobilise resources to undertake water quality monitoring (OM03).	Planning or Environment	**DAY 3:** Water quality assessments access and capability.		Detecting and Monitoring for the Presence and Properties of Hydrocarbons in the Marine Environment (OM03 of The Operational Monitoring Operational Plan).
	Yes	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 specialist fo reach of the Response Protection Areas (RPA) with predicted impacts.		Pre-emptive Assessment of Sensitive Receptors (OM04 of The Operational Monitoring Operational Plan).

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Response Techniques	**Hydrocarbon Type**		**Pre- Identified Tactics**	**Responsible**	**ALARP Commitment Summary**	**Complete ✓**	**Link to Operational Plans for notification numbers and actions**
	Marine Diesel Oil	**Crude**					
	Yes	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 two specialists in SCAT for each of the RPAs with predicted impacts.		Shoreline Assessment (OM05 of The Operational Monitoring Operational Plan).

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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 Balnaves Plug and Abandonment Environment Plan Appendix D (Woodside's Oil Spill Preparedness and Response Mitigation Assessment).

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Table 3-1: Level 2/3 Response Summary

Response Techniques	Hydrocarbon Type		Pre- Identified Tactics	Responsible	ALARP Commitment Summary	Complete ✓	Link to Operational Plans for notification numbers and actions
	Marine Diesel Oil	Balnaves Crude					
Monitor and Evaluate (Operational Monitoring)	Yes	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).	Intelligence or Environment	**DAY 1:** Initial modelling within six hours using the Rapid Assessment Tool. Detailed modelling within four hours of RPS receiving information from Woodside.		Predictive Modelling of Hydrocarbons to Assess Resources at Risk (OM01 of The Operational Monitoring Operational Plan).
	Yes	Yes	Send Oil Spill Trajectory Modelling (OSTM) form (Appendix B Form 7) to RPS Response team ([redacted]) and call RPS Response Duty Officer Phone [redacted] [redacted]	Intelligence	**DAY 1:** Detailed modelling within 4 hours of RPS receiving information from Woodside.		
	Yes	Yes	If a vessel is on location, confirm whether the tracking buoy has been deployed. Consider the need to mobilise the satellite tracking buoys from the KBSB Stockpile.	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).
	Yes	Yes	Instruct Aviation Duty Manager to commence aerial observations in daylight hours. Aerial surveillance observer to complete log in Appendix B Form 8.	Logistics - Aviation	**DAY 1:** Two trained aerial observers. One aircraft available.		
	Yes	Yes	The Intelligence duty manager should be instructed to stand up Kongsberg Satellite Services (KSAT) to provide satellite imagery of the spill. [redacted] [redacted]	Intelligence	**DAY 1:** Service provider will confirm availability of an initial acquisition within two hours. Data received to be uploaded into		

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Response Techniques	**Hydrocarbon Type**		**Pre- Identified Tactics**	**Responsible**	**ALARP Commitment Summary**	**Complete ✓**	**Link to Operational Plans for notification numbers and actions**
	Marine Diesel Oil	**Balnaves Crude**					
					Woodside Common Operating Picture.		
	Yes	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).
	Yes	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).
	Yes	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 two specialists in SCAT for each of the RPAs with predicted impacts.		Shoreline Assessment (OM05 of The Operational Monitoring Operational Plan).
Surface Dispersant	No	No	This response strategy is not recommended.				
Mechanical Dispersion	No	No	This response strategy is not recommended.				

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Response Techniques	**Hydrocarbon Type**		**Pre- Identified Tactics**	**Responsible**	**ALARP Commitment Summary**	**Complete ✓**	**Link to Operational Plans for notification numbers and actions**
	Marine Diesel Oil	**Balnaves Crude**					
Containment and Recovery	No	No	This response strategy is not recommended.				
In-situ Burning	No	No	This response strategy is not recommended.				
Shoreline Protection and Deflection	No	No	This response strategy is not recommended.				
Shoreline Clean Up	No	Potentially	Equipment from Woodside, AMOSC and AMSA Western Australian Stockpiles and relevant personnel mobilised. Consideration of mobilisation of interstate/international shoreline clean-up equipment and relevant personnel (i.e. OSRL).	Logistics and Planning	**DAY 1:** Equipment mobilised from closest stockpile within 12 hours TRPs available for at risk shorelines within 24 hours. **DAY 2:** Deployment of shoreline clean-up teams to contaminated RPAs. Access to at least 2800 m^3 of solid and liquid waste storage available within 4 days upon activation of 3rd party contract.		Shoreline Clean-up Operational Plan *Logistics to download immediately and follow steps*
Oiled Wildlife Response	Yes	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.	Logistics and Planning	**DAY 5:** Contracted capability to treat up to an additional 250 individual fauna within a five-day period.		Oiled Wildlife Response Operational Plan

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Response Techniques	**Hydrocarbon Type**		**Pre- Identified Tactics**	**Responsible**	**ALARP Commitment Summary**	**Complete ✓**	**Link to Operational Plans for notification numbers and actions**
	Marine Diesel Oil	**Balnaves Crude**					
			Consider whether additional equipment is required from local suppliers.		Facilities for oiled wildlife rehabilitation are operational 24/7		
Scientific Monitoring (Type II)	Yes	Yes	Notify Woodside science team of spill event.	Environment			Oil Spill Scientific Monitoring Programme – Operational Plan Link
For well integrity event, the following strategies apply:							
Subsea First Response Toolkit	No	Yes	Debris clearance equipment may require mobilisation prior to the undertaking of any further source control activities deployment of SSDI equipment. Source control via ROV intervention using the LWI well control package or subsea tree may be feasible. Suitable for Credible Scenario-01.	Operations and Logistics	**DAY 2:** Remotely Operated Vehicle (ROV) ready for deployment within 48 hours		Subsea First Response Toolkit (SFRT) and Capping Stack Operational Plan Link Balnaves P&A Source Control Emergency Response Plan (SCERP)
Subsea Dispersant	No	No	This response strategy is not recommended.				
Capping Stack	No	Yes	Woodside has developed a project specific source control emergency response plan (SCERP) for the Balnaves Plug and Abandonment activity and considers that capping is feasible if safety of response personnel, and plume and environmental conditions permit.	Operations (Source Control Unit)	**DAY 16:** Capping stack deployed by a chartered construction vessel.		
Relief Well	No	Yes	As per Balnaves P&A Source Control Emergency Response Plan (SCERP)	Operations (Source Control Unit)	**DAY 1:** Commence sourcing and contracting MODU		

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) are used to determine the Zone of Consequence (ZoC) identified in the Environment Plan and are lower than response thresholds (**Table 4-1**).

Table 4-1: Response Thresholds

Surface Hydrocarbon (g/m^2)	Description
>10	Predicted minimum threshold for commencing operational monitroing
50	Predicted minimum floating oil threshold for containment and recovery and surface dispersant application [2]
100	Predicted optimum floating oil threshold for containment and recovery and surface dispersant application
100	Predicted minimum shoreline accumulation threshold for shoreline assessment operations
250	Predicted minimum threshold for commencing shoreline clean-up operations

Table 4-2: Receptors for Priority Protection with Potential Impact within 48 Hours (Credible Scenario-01 and Credible Scenario 05)

Receptor	Distance and Direction from Operational Area (km)	Minimum time to shoreline contact (above 100g/m^2) in days	Maximum shoreline accumulation (above 100g/m^2) in m^3	Tactical Response Plans (also available within the Data Directory DRIMS#9542566)
Open Ocean – Commonwealth Waters (incl. Montebello AMP)	0 km (open ocean) 3 km NE (Montebello AMP)	N/A	N/A	N/A

Hydrocarbon spill modelling results indicate the sensitive receptors listed below have the potential to be contacted by hydrocarbons beyond 48 hours of a spill:

- Barrow Island
- Montebello Islands
- Pilbara Islands – Northern, Middle and Southern Island Groups
- Muiron Islands
- Ningaloo Coast – North, Middle and South
- Boodie Island
- Submerged Receptors: Rankin Bank, Montebello Shoals, Rosily Shoals, Poivre Reef and Tryall Rocks

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[2] At 50g/m^2 containment and recovery and surface dispserant 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.

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Tactical Response plans for these locations can be accessed via the Oil Spill Portal - Tactical Response Plans.[3]

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 illustrates the location of regional sensitive receptors in relation to the Balnaves Plug and Abandonment operational area and identifies priority protection areas.

Consideration should be given to other stakeholders (including mariners) in the vicinity of the spill location. **Table 4-2** indicates the assets within the vicinity of the Balnaves Plug and Abandonment operational area.

Table 4-3: Assets in the vicinity of the Balnaves Plug and Abandonment operational area

Asset	Distance and Direction from Operational Area	Operator
Pluto Platform	~ 14 km NE	Woodside
Wheatstone Platform	~ 22 km NE	Chevron
John Brookes Field	~ 39 km SE	Santos WA Southwest P/L

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[3] The Tactical Response Plans for the RPA's idenitifed contain the details of potential forward operating bases and staging areas. Incident Command Centre: For Level 1 incidents the in-field team and asset operator will lead the response on-scene. For level 2/3 Incident the Incident command centre will be located in Perth at Woodside's Building. The Woodside CICC is fully equipped with communications equipment and technology to ensure the coordination of response activities for the overall response.

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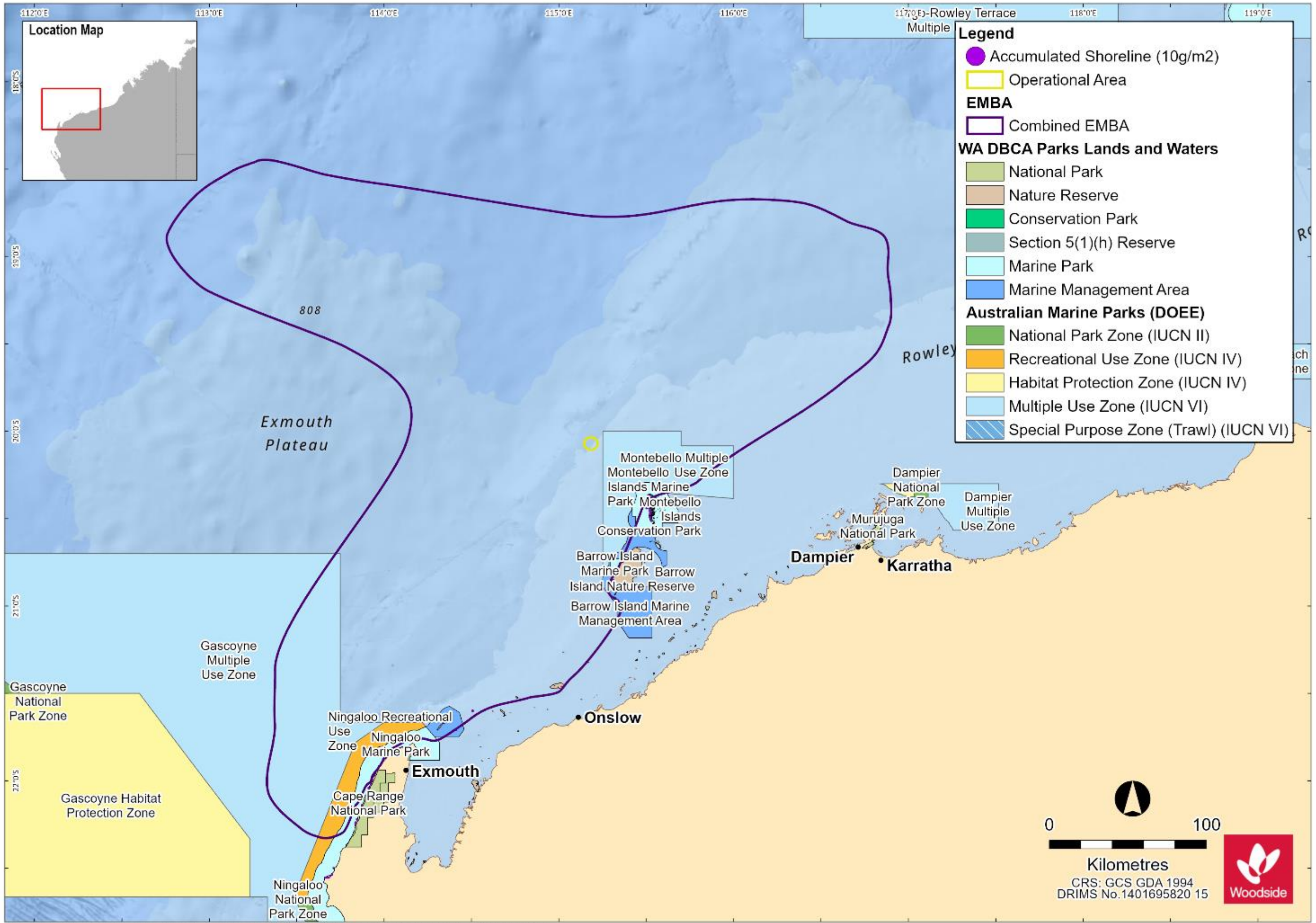

Sources: Esri, HERE, Garmin, GEBCO, National Geographic, NOAA, and the GIS User Community, Esri, Garmin, GEBCO, NOAA NGDC, and other contributors

Figure 4-1: Regional Sensitive Receptors – Balnaves Plug and Abandonment

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5. DISPERSANT APPLICATION

Dispersant is not considered an appropriate response strategy for this activity as described in the Balnaves Plug and Abandonment Environment Plan Appendix D (Woodside's Oil Spill Preparedness and Response Mitigation Assessment).

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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*
CS-01 (WCCS) **67-day uncontrolled surface/subsurface loss of well containment during well abandonment:**	Balnaves crude (API 48.8°)	14,113 m^3	Kutubu, Shell Oil (API 43.4°)
CS-02 **Subsurface leak caused by accidental removal or failure of a Xmas tree during preservation period. 67-day uncontrolled subsea release.**	Balnaves crude (API 48.8°)	390 m^3	Kutubu, Shell Oil (API 43.4°)
CS-03 **Subsurface leak caused by accidental removal or failure of a Xmas tress during well P&A. 67-day uncontrolled subsea release.**	Balnaves crude (API 48.8°)	390 m^3	Kutubu, Shell Oil (API 43.4°)
CS-04 **Instantaneous loss of containment caused by refuelling hose failure, coupling failure or operator error.**	Marine diesel (API 37.2°)	8 m^3	Diesel Fuel Oil (API 37.2°)
CS-05 (WCCS) **Instantaneous unplanned hydrocarbon release caused by marine vessel collision**	Marine diesel (API 37.2°)	550 m^3	Diesel Fuel Oil (API 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.

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Balnaves Crude (Group 1 Oil)

Balnaves crude is a mixture of volatile and persistent hydrocarbons with high proportions of volatile and semi-volatile components. In favourable evaporation conditions, about 47.7% of the oil mass should evaporate within the first 12 hours (BP < 180 °C); a further 20.7% should evaporate within the first 24 hours (180 °C < BP < 265 °C); and a further 23.2% should evaporate over several days (265 °C < BP < 380 °C). Approximately 8.4% of the oil is shown to be persistent.

The whole oil has a low asphaltene content (~0.5%), indicating a low propensity for the mixture to take up water to form water-in-oil emulsion over the weathering cycle.

Soluble, aromatic, hydrocarbons contribute approximately 4.4% by mass of the whole oil. Around 2.8% by mass is highly soluble and highly volatile. A further 1.6% by mass has semi-to-low volatility. These compounds dissolve more slowly but tend to persist in soluble form for longer. Discharge onto the water surface will favour the process of evaporation over dissolution under calm sea conditions, but increased entrainment of oil and dissolution of soluble compounds can be expected under breaking wave conditions.

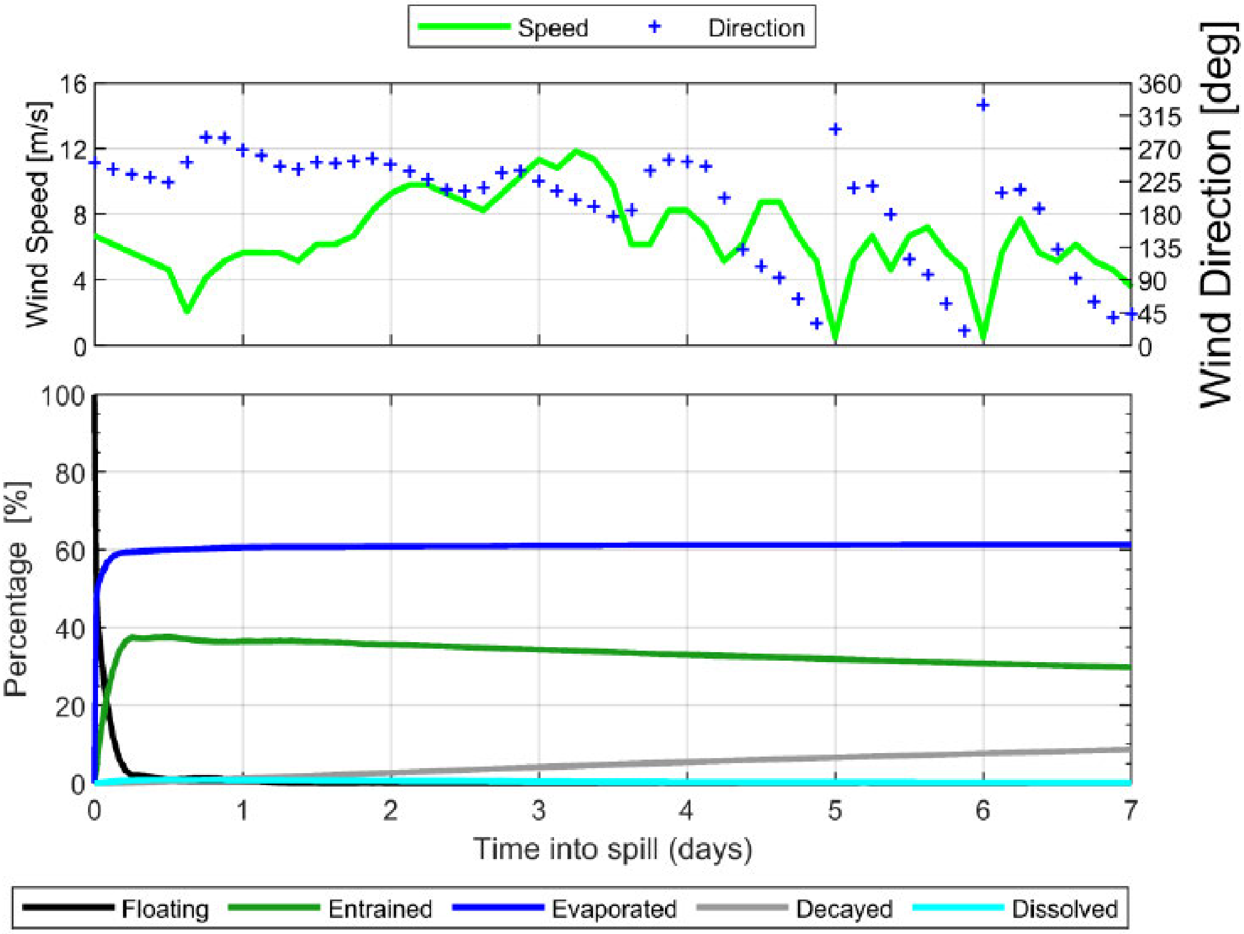

Figure A-0-1 Proportional mass balance plot representing the weathering of Balnaves crude spilled onto the water surface as a one-off instantaneous release and subject to variable wind at 27 °C water temperature and 25 °C air temperature.

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Marine Diesel (Group 2 Oil)

Marine diesel is a mixture of volatile and persistent hydrocarbons, with approximately 40-50% by mass predicted to evaporate over the first day or two, depending upon the prevailing conditions, with further evaporation slowing over time. The heavier components of diesel have a strong tendency to entrain into the upper water column due to wind waves, but can refloat to the surface if wind waves abate.

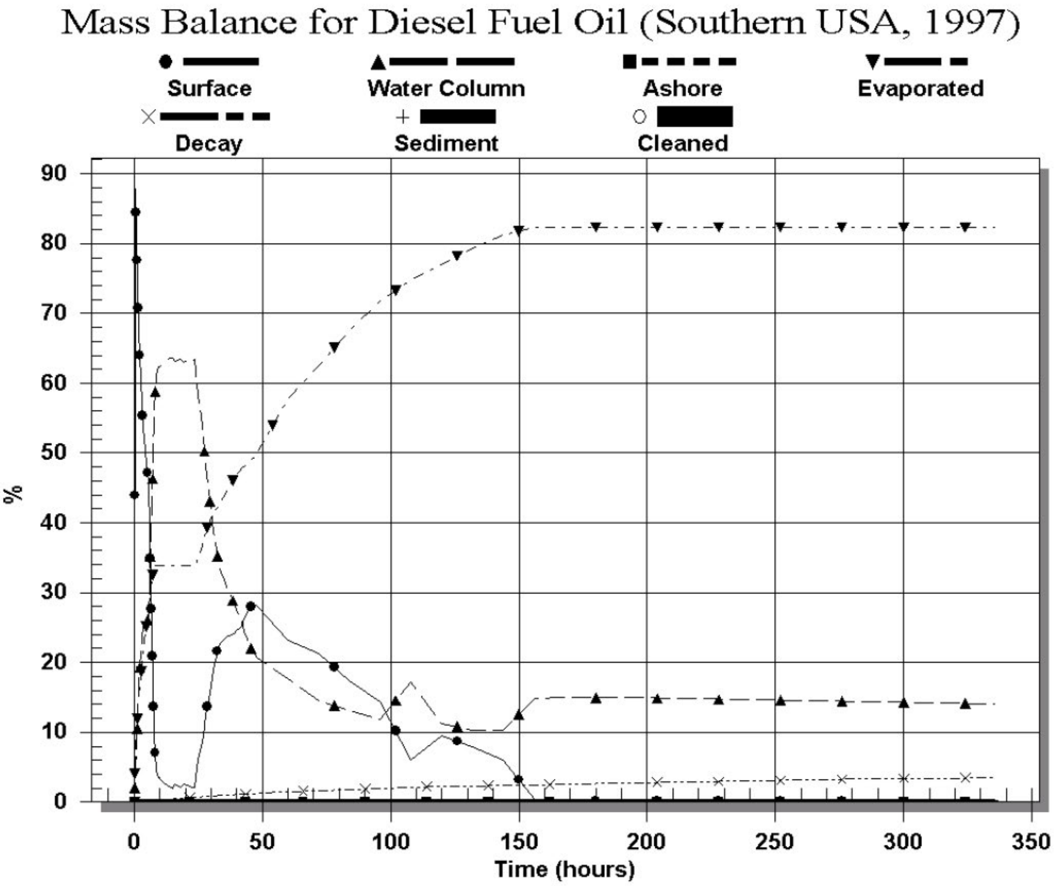

Figure A-0-2 Predictions for the partitioning of oil mass over time through weathering processes for diesel fuel oil. Predictions are based on sample environmental conditions.

Source: Data available from the RPS oil database (Diesel Fuel Oil (Southern USA 1997)). NOTE: This information is provided as guidance only. Spill event OSTM should be sought.

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APPENDIX B – FORMS

Form No.	Form Name	Link
1	Record of Verbal Notification to Regulator Template	Link
2	NOPSEMA Notification Template	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	RPS Response Oil Spill Trajectory Modelling Request	Link
8	Aerial Surveillance Observer Log	Link

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FORM 1

Record of initial verbal notification to NOPSEMA

Woodside

(NOPSEMA ph: [redacted]

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	

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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** [redacted]
2. **NOPTA** [redacted]
3. **DMIRS** [redacted]

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FORM 2

[insert NOPSEMA Notification Template when printing]

Link

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FORM 3

[insert Marine Pollution Report (POLREP – AMSA) when printing]

Link

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FORM 4

[insert AMOSC Service Contract note when printing]

Link

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FORM 5

[insert Marine Pollution Report (POLREP – DoT) when printing]

Link

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FORM 6a

[insert OSRL Initial Notification Form when printing]
Link

FORM 6b

[insert OSRL Mobilisation Activation Form when printing]
Link

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FORM 7

[insert RPS Response Oil Spill Trajectory Modelling Request form when printing]

Link

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FORM 8

[insert Aerial Surveillance Observer Log when printing]

Link

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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	

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APPENDIX D – TRACKING BUOY DEPLOYMENT INSTRUCTIONS

(Insert Link when printing)

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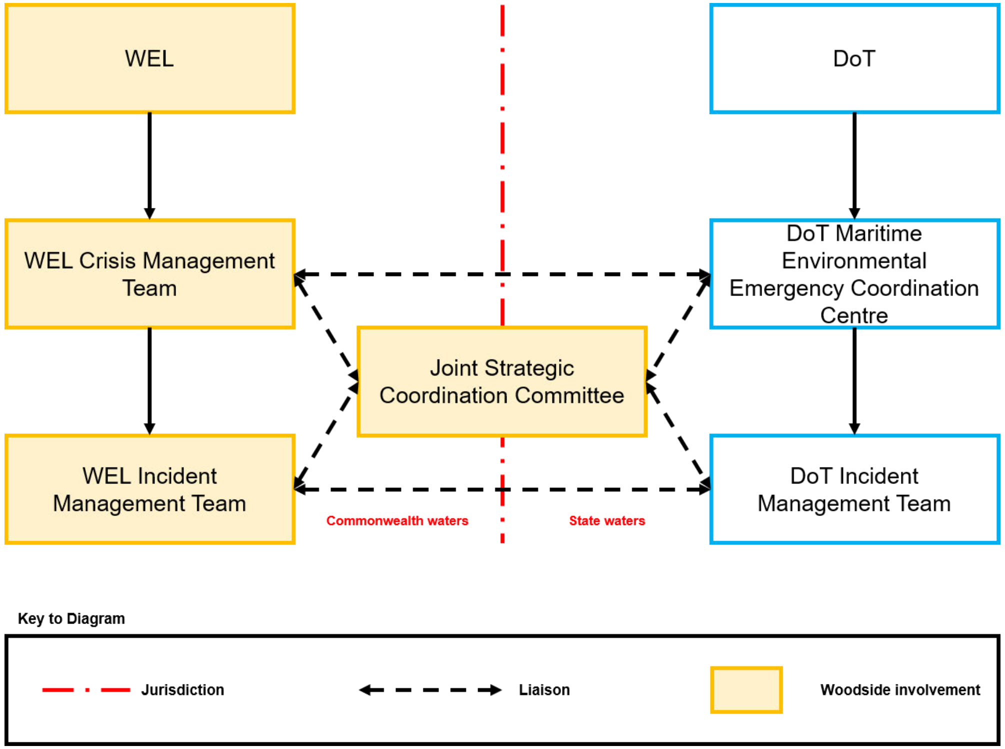
APPENDIX E – COORDINATION STRUCTURE FOR A CONCURRENT HYDROCARBON SPILL IN BOTH COMMONWEALTH AND STATE WATERS/SHORELINES[4]



The Control Agency for a hydrocarbon spill in Commonwealth waters resulting from an offshore petroleum activity is Woodside (the Petroleum Titleholder). The Control Agency for a 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.

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[4] Adapted from DoT Offshore Petroleum Industry Guidance Note, Marine Oil Pollution: Response and Consultation Arrangements July 2020. Note: For full structure up to Commonwealth Cabinet/Minister refer to Marine Oil Pollution: Response and Consultation Arrangements Section 6.5, Figure 3.

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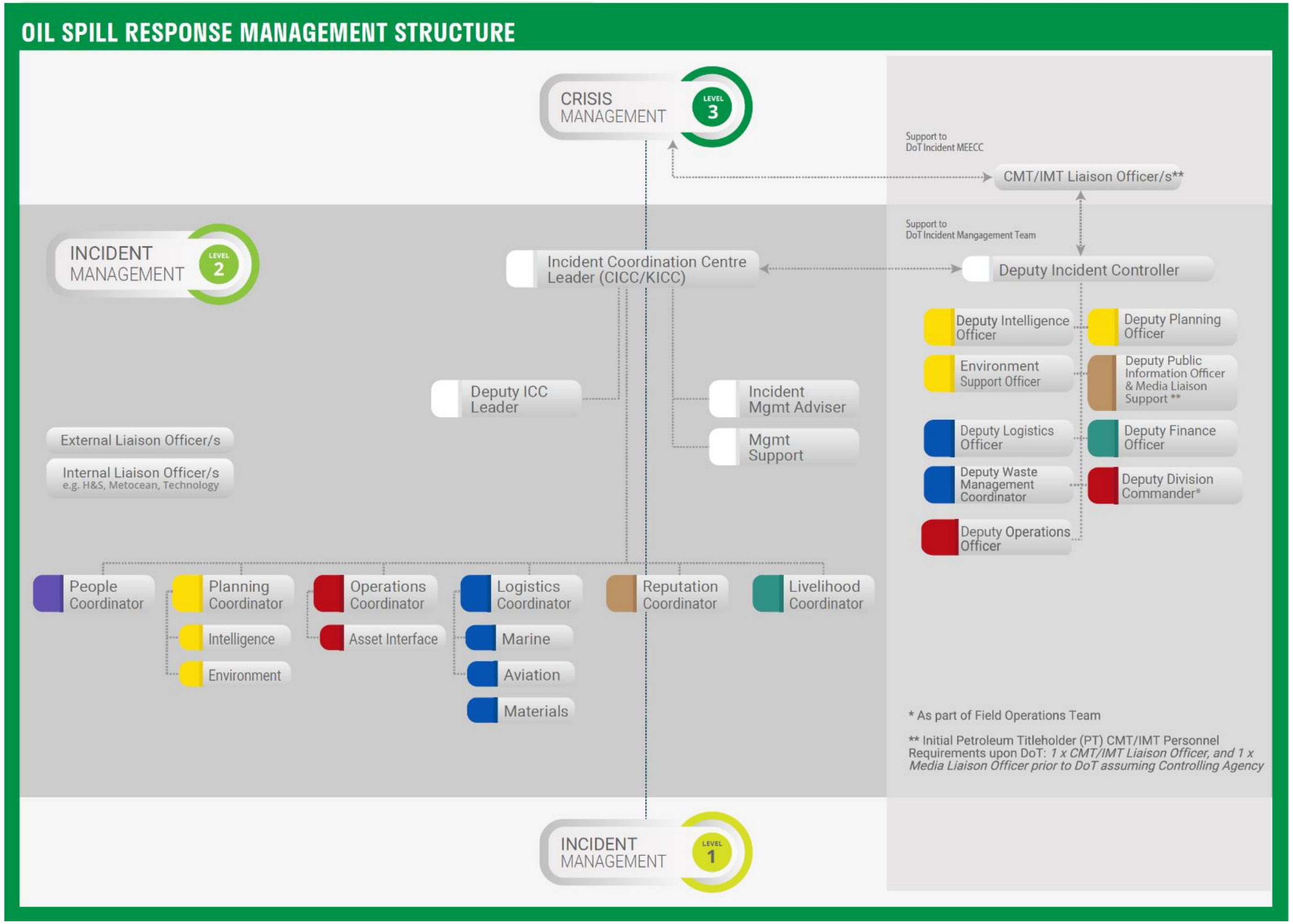
APPENDIX F – WOODSIDE INCIDENT MANAGEMENT STRUCTURE

Woodside Incident Management Structure for Hydrocarbon Spill (including Woodside Liaison Officers Command Structure within DoT IMT if required).


OIL SPILL RESPONSE MANAGEMENT STRUCTURE

* As part of Field Operations Team

** Initial Petroleum Titleholder (PT) CMT/IMT Personnel Requirements upon DoT: *1 x CMT/IMT Liaison Officer, and 1 x Media Liaison Officer prior to DoT assuming Controlling Agency*

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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 Leader Roster	• Provide a direct liaison between the CMT and the MEECC. • Facilitate effective communications and coordination between the CMT Leader and State Marine Pollution Coordinator (SMPC). • Offer advice to SMPC on matters pertaining to PT crisis management policies and procedures.	1
DoT IMT Incident Control	WEL Deputy Incident Controller	CICC Leader 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 Intelligence	Intelligence Support Officer/ Deputy Intelligence Officer	AMOSC Staff Member or AMOSC Core Group	• As part of the Intelligence Team, assist the Intelligence Officer in the performance of their duties in relation to situation and awareness. • Facilitate the provision of relevant modelling and 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 Intelligence – Environment	Environment Support Officer	CMT Environmental FST Duty Managers Roster	• As part of the Intelligence Team, assist the Environment Coordinator in the performance of their duties in relation to the provision of environmental support into the planning process. • 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	Deputy Planning Officer	AMOSC Core Group/CICC Planning	• As part of the Planning Team, assist the Planning Officer in the performance of their duties in relation to the interpretation of existing response plans and the development of incident action plans and related sub plans.	1

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[5] See [redacted]

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Area	WEL Liaison Role	Personnel Sourced from[5]:	Key Duties	#
Planning-Plans/ Resources		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. **(Note this individual must have intimate knowledge of the relevant PT OPEP and planning processes)**	
DoT IMT Public Information-Media/ Community Engagement	Public Information Support and Media Liaison Officer/ Deputy Public Information Officer	Reputation (Media) FST Duty Manager Roster	• As part of the Public Information Team, provide a direct liaison 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 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	Deputy Logistic Officer	Services FST Logistics Team 2 Roster	• As part of the Logistics Team, assist the Logistics Officer in the performance of their duties in relation to the provision of supplies to sustain the response effort. • 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. **(Note this individual must have intimate knowledge of the relevant PT logistics processes and contracts)**	1
DoT IMT Finance-Accounts/	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 the PTs existing OSRL, AMOSC and private contract arrangements. • Facilitate the communication of financial monitoring information to the PT to allow them to track the overall cost of the response.	1

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Area	WEL Liaison Role	Personnel Sourced from[5]:	Key Duties	#
Financial Monitoring			• Assist the Finance Officer in the tracking of financial commitments through the response, including the supply contracts commissioned directly by DoT and to be charged back to the PT.	
DoT IMT Operations	Deputy Operations Officer	CICC Operations Coordinator Roster	• As part of the Operations Team, assist the Operations Officer in the performance of their duties in relation to the implementation and management of operational activities undertaken to resolve an incident. • Facilitate effective communications and coordination between the PT Operations Section and the DoT Operations Section. • Offer advice to the DoT Operations Officer on matters pertaining to PT incident response procedures and requirements. • Identify efficiencies and assist to resolve potential conflicts around resource allocation and simultaneous operations of PT and DoT response efforts.	1
DoT IMT Operations – Waste Management	Facilities Support Officer/ Deputy Waste Management Coordinator	Services FST Logistics Team 2 and WEL Waste Contractor Roster	• As part of the Operations Team, assist the Waste Management Coordinator in the performance of their duties in relation to the provision of the management and disposal of waste collected in State waters. • Facilitate the disposal of waste through the PT's existing private contract arrangements related to waste management and in line with legislative and regulatory requirements. • Collects Request Forms from DoT to action via PT IMT.	1
DoT FOB Operations Command	Deputy On-Scene Commander/ Deputy Division Commander	AMOSC Core Group	• As part of the Field Operations Team, assist the Division Commander in the performance of their duties in relation to the oversight and coordination of field operational activities undertaken in line with the IMT Operations Section's direction. • Provide a direct liaison between the PT FOB and DoT FOB. • Facilitate effective communications and coordination between the PT Division Commander and the DoT Division Commander. • Offer advice to the DoT Division Commander on matters pertaining to PT incident response policies and procedures. • Assist the Safety Coordinator deployed in the FOB in the performance of their duties, particularly as they relate to PT employees or contractors. • Offer advice to the Safety Coordinator deployed in the FOB on matters pertaining to PT safety policies and procedures.	1
			Total Woodside personnel initially required in DoT IMT	11

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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 (prior to DoT assuming Controlling Agency) / Deputy Incident Controller – State waters (after DoT assumes Controlling Agency)	DoT	• Facilitate effective communications between DoT's SMPC/ Incident Controller and the Petroleum Titleholder's appointed CMT Leader / Incident Controller. • Provide enhanced situational awareness to DoT of the incident and the potential impact on State waters. • Assist in the provision of support from DoT to the Petroleum Titleholder. • Facilitate the provision technical advice from DoT to the Petroleum Titleholder Incident Controller as required.	1
WEL Reputation FST (Media Room)/ Public Information – Media	DoT Media Liaison Officer	DoT	• Provide a direct liaison 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 & 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

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