Scarborough Seabed Intervention and Trunkline Installation Environment Plan

January 2022

Revision 1

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1. INTRODUCTION

1.1 Overview

The Scarborough gas resource, located in Commonwealth waters approximately 375 km west-northwest of the Burrup Peninsula, forms part of the Greater Scarborough gas fields, comprising the Scarborough, North Scarborough, Thebe and Jupiter gas fields (**Figure 3-1**). Woodside Energy Scarborough Pty Ltd (Woodside), as Titleholder under the *Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2009* (Cth) (referred to as the Environment Regulations), proposes to undertake the following petroleum activities:

- installation and pre-commissioning of the trunkline
- installation of Pipeline End Termination (PLET) and foundations
- seabed intervention activities to support the trunkline.

These activities will hereafter be referred to as the Petroleum Activities Program and form the scope of this Environment Plan (EP). This EP has been prepared by Woodside as part of the requirements under the Environment Regulations, as administered by the National Offshore Petroleum Safety and Environmental Management Authority (NOPSEMA).

The Petroleum Activities Program as defined in this EP is a part of the broader Scarborough Offshore Project Proposal (Scarborough OPP) accepted by NOPSEMA on 30 March 2020.The Scarborough primary approval process is outlined in **Section 1.10.3.1** and **Section 3.3** highlights concordance with the Scarborough OPP.

1.2 Defining the Petroleum Activity

The Petroleum Activities Program to be undertaken comprises pipeline construction activities and work and other things that are necessary for, or incidental to the construction of a pipeline as defined under section 211(1)(d)(i) of the OPGGS Act, to be specified in the proposed pipeline licence, which are petroleum activities as defined in Regulation 4 of the Environment Regulations.

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 performed in a manner consistent with the principles of ecologically sustainable development (as defined in Section 3A of the Environment Protection and Biodiversity Conservation Act, 1999 (Cth) (EPBC Act)).

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

The EP defines activity-specific Environmental Performance Outcomes (EPOs), environmental performance standards (EPSs) and measurement criteria (MCs). These form the basis for monitoring, auditing and management of the Petroleum Activities Program to be undertaken by Woodside and its contractors. The implementation strategy (derived from the decision support framework tools) specified within 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 of the Petroleum Activities Program has been described and assessed using two 'areas', the Trunkline Project Area, (the proposed trunkline from and 1.5 km either side of the proposed trunkline centreline) and the Offshore Borrow Ground Project Area. The combination of the Project Areas defines the Operational Area and the spatial boundary of the Petroleum Activities Program, as described, risk assessed and managed by this EP, including vessel related petroleum activities.

This EP addresses potential environmental impacts from planned activities within the Operational Area and any potential unplanned events that originate from the activity within the Operational Area.

Transit to and from the Operational Area by project vessels as well as port activities associated with these vessels, are not within the scope of this EP. Vessels supporting the petroleum activities operating outside the Operational Area (e.g. transiting to and from port, materials transhipment) 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, addressing the items listed in **Table 1-1** as required by Regulation 11(4).

Table 1-1: EP Summary

EP Summary material requirement	Relevant section of EP containing EP Summary material
The location of the activity	**Section 3.4**
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**
Response arrangements in the oil pollution emergency plan	**Section 7.15**
Consultation already undertaken and plans for ongoing consultation	**Section 5**
Details of the titleholders nominated liaison person for the activity	**Section 1.8**

1.6 Structure of the Environment Plan

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

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

Criteria for acceptance	Content requirements/relevant regulations	Elements	Section of EP
Regulation 10A(a): *Is appropriate for the nature and scale of the activity*	Regulation 13: *Environmental assessment* Regulation 14: *Implementation strategy for the environment plan* Regulation 16: *Other information in the environment plan*	The principle of 'nature and scale' is applicable throughout the EP.	**Section 2** **Section 3** **Section 4** **Section 5** **Section 6** **Section 7**
Regulation 10A(b): *Demonstrates that the environmental impacts and risks of the activity will be reduced to as low as reasonably practicable* Regulation 10A(c): *Demonstrates that the environmental impacts and risks of the activity will be of an acceptable level*	Regulation 13(1)–13(7): *13(1) Description of the activity* *13(2)(3) Description of the environment* *13(4) Requirements* *13(5)(6) Evaluation of environmental impacts and risks* *13(7) Environmental Performance Outcomes and standards* *Regulation 16(a) to 16(c):* *A statement of the titleholder's corporate environmental policy* *A report on all consultations between the titleholder and any relevant person*	Set the context (activity and existing environment). Define 'acceptable' (the requirements, the corporate policy, relevant persons). Detail the impacts and risks. Evaluate the nature and scale. Detail the control measures – ALARP and acceptable.	**Section 1** **Section 2** **Section 3** **Section 4** **Section 5** **Section 6** **Section 7**
Regulation 10A(d): *Provides for appropriate Environmental Performance Outcomes, environmental performance standards and measurement criteria*	Regulation 13(7): *Environmental Performance Outcomes and standards*	Environmental Performance Outcomes (EPO). Environmental performance standards (EPS). 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: • Environmental Management System (EMS) • Performance monitoring • Oil Pollution Emergency Plan (OPEP– per **Table 7-7**) and scientific monitoring • Ongoing consultation	**Section 7**

Criteria for acceptance	Content requirements/relevant regulations	Elements	Section of EP
Regulation 10A(f): *Does not involve the activity or part of the activity, other than arrangements for environmental monitoring or for responding to an emergency, being undertaken in any part of a declared World Heritage property within the meaning of the Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act)*	Regulation 13(1)–13(3): *13(1) Description of the activity* *13(2) Description of the environment* *13(3) Without limiting [Regulation 13(2)(b)], relevant values and sensitivities may include any of the following:* *(a) the world heritage values of a declared World Heritage property within the meaning of the EPBC Act;* *(b) the national heritage values of a National Heritage place within the meaning of that Act;* *(c) the ecological character of a declared Ramsar wetland within the meaning of that Act;* *(d) the presence of a listed threatened species or listed threatened ecological community within the meaning of that Act;* *(e) the presence of a listed migratory species within the meaning of that Act;* *(f) any values and sensitivities that exist in, or in relation to, part or all of:* *(i) a Commonwealth marine area within the meaning of that Act; or* *(ii) Commonwealth land within the meaning of that Act.*	No activity, or part of the activity, undertaken in any part of a declared World Heritage property.	**Section 3** **Section 4**
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 undertaken in the preparation of this EP.	**Section 4**
Regulation 10A(h): *Complies with the Act and the regulations*	Regulation 13(4)a: *Describe the requirements, including legislative requirements, that apply to activity and are relevant to the environmental management of the activity* *Regulation 15:* *Details of the Titleholder and liaison person* *Regulation 16(a):* *A statement of the titleholder's corporate environmental policy* *Regulation 16(c):* *Details of all reportable incidents in relation to the proposed activity*	All contents of the EP must comply with the *Offshore Petroleum and Greenhouse Gas Storage Act 2006* and the Environment Regulations	**Section 1** **Section 3** **Section 6** **Appendix A** **Appendix B**

1.7 Description of the Titleholder

Woodside is Operator of the various joint ventures relating to the Scarborough Project, which comprises the Scarborough, North Scarborough, Thebe and Jupiter fields. The joint ventures comprise both Woodside and BHP Petroleum (Australia) Pty Ltd (**"BHP"**).

As Australia's leading LNG operator, Woodside operated 6% of global LNG supply in 2020. LNG is a lower-emissions, competitive fuel ideally suited to supporting decarbonisation and improving air quality. Woodside is working to improve its energy efficiency, offset emissions, reduce emissions intensity and explore options for lower-carbon energy. Woodside has set clear targets to reduce our net emissions in line with our aspiration to achieve net zero by 2050.

In Western Australia, Woodside is building on more than 30 years of experience and progressing development of the Scarborough gas resource through the world-class Pluto LNG facility. Woodside is also connecting Pluto LNG with the landmark North West Shelf Project to create an integrated LNG production hub on the Burrup Peninsula.

Woodside recognises that strong environmental performance is essential to success and continued growth. Woodside has an established methodology to identify impacts and risks and assess potential consequences of activities. Strong partnerships, sound research and transparency are the key elements of Woodside's approach to the environment.

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 Scarborough Pty Ltd:
11 Mount Street, Perth, Western Australia
Telephone: 08 9348 4000
Fax Number: 08 9214 2777
ABN: 650 177 227

1.8.2 Nominated Liaison Person

Ryan Felton
Senior Corporate Affairs Advisor
11 Mount Street, Perth, Western Australia
Phone: 08 9348 4000
Fax Number: 08 9214 2777
feedback@woodside.com.au

1.8.3 Arrangements for Notifying of Change

Should the titleholder, titleholder's nominated liaison person or the contact details for either change, then NOPSEMA are to 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 2.2.3** are drawn from the WMS documentation, which comprises of four elements: Compass and Policies, Expectations, Processes and Procedures, and Guidelines, 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 development of processes and procedures.
- **Processes and Procedures**: Processes identify the set of interrelated or interacting activities which transforms inputs into outputs, to systematically achieve a purpose or specific objective. Procedures specify what steps, by whom and when are required to carry out an activity or a process.
- **Guidelines**: Provide recommended practice and advice on how to perform the steps defined in Procedures, together with supporting information and associated tools. Guidelines provide advice on: how activities or tasks may be performed; information that may be taken into consideration; or, how to use tools and systems.

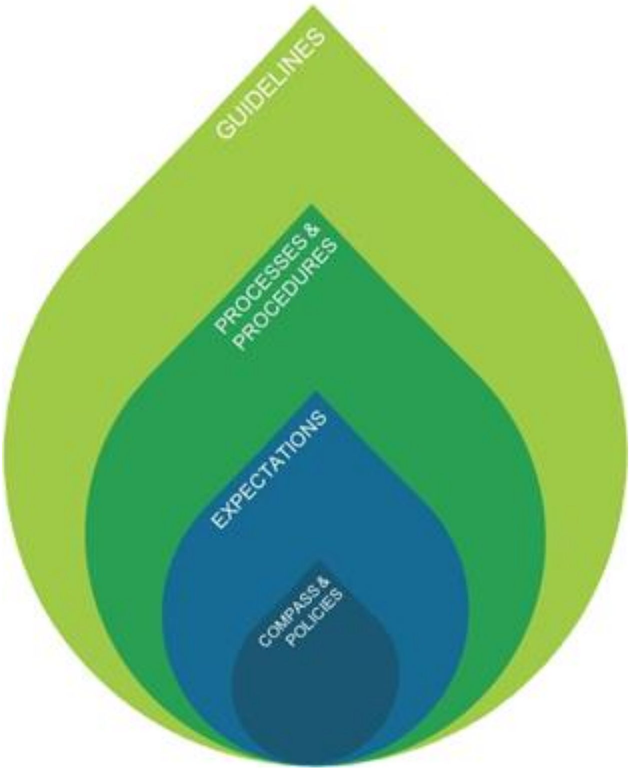


Figure 1-1: The four major elements of the WMS framework

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 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 (E and P) lifecycle. The management activities influence all areas of the business, while support activities may influence one or more value stream activities.

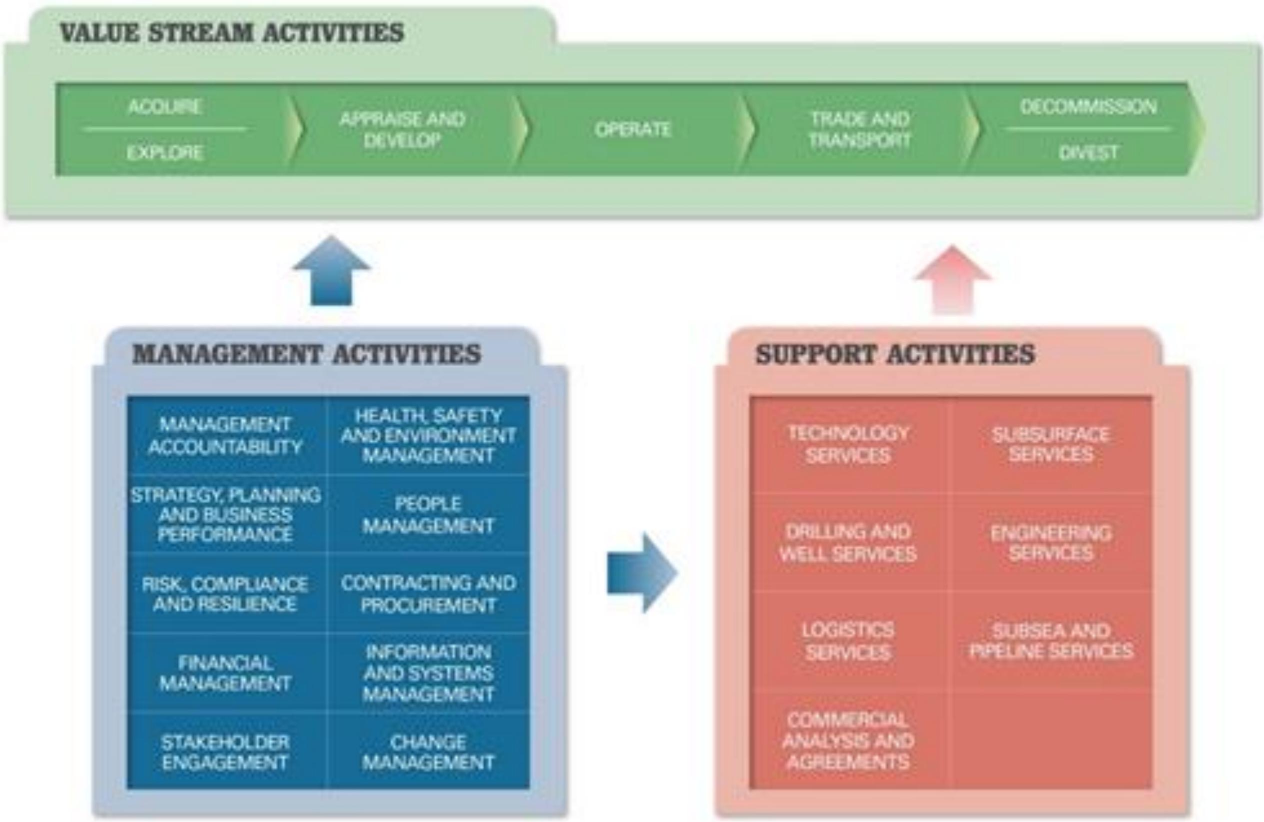


Figure 1-2: The WMS business process hierarchy

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 relevant to the management of risks and impacts of the Petroleum Activities Program are detailed in **Appendix B**.

1.10.1 Offshore Petroleum and Greenhouse Gas Storage Act 2006

The Commonwealth *Offshore Petroleum and Greenhouse Gas Storage Act 2006* (OPGGS Act) provides the regulatory framework for all offshore petroleum exploration and production and greenhouse gas activities in Commonwealth waters (the ocean area beyond three nautical miles to the outer extent of the Australian Exclusive Economic Zone at 200 nautical miles).

The Act manages all offshore petroleum activities, including decommissioning, under Section 572 and 270. While there are no immediate plans for decommissioning (the scope of this EP is for the installation of the trunkline for future operations) all equipment, being installed above the mudline, design allows for removal. Subsection 572(2) provides that while structures, equipment and other property remain in the title area, they must be maintained in good condition and repair.

The regulatory framework establishes the National Offshore Petroleum Safety and Environment Management Authority as the regulator. The OPGGS Regulations, including the *Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations* 2009 (the Environment Regulations), ensure petroleum activities are performed in a manner:

- consistent with the principles of ecologically sustainable development (as set out in the EPBC Act)
- by which the environmental impacts and risks of the activity will be reduced to ALARP
- by which the environmental impacts and risks of the activity will be of an acceptable level.

1.10.2 Sea Dumping Act

In Australia dumping at sea of dredged material is regulated under the Environment Protection (Sea Dumping) Act 1981 (Sea Dumping Act). Under the Sea Dumping Act, the Commonwealth aims to minimise pollution threats by:

- prohibiting, without a permit, ocean dumping of material that is considered to be “seriously harmful” and
- regulating permitted waste disposal.

Permit applications are assessed under a regulatory framework, which encompasses evaluating disposal alternatives and waste minimisation procedures, site and impact assessments and management and monitoring programs. A sea dumping permit (SD2019-3982) for this activity was granted to Woodside in December 2019. The scope of this sea dumping permit includes the use of spoil ground 5A (an activity proposed in this EP).

1.10.3 Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act)

One of the objectives of the 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 ecological sustainable development. 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 EPBC 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 EPBC Act

1.10.3.1 Offshore Project Proposal

Woodside submitted the Scarborough OPP to NOPSEMA for assessment in February 2019 and received approval in March 2020. In accordance with Regulation 31 of the Environment Regulations, references to the Scarborough OPP have been made throughout this EP. The approved Scarborough OPP is available on the NOPSEMA website: Scarborough Offshore Project Proposal » NOPSEMA.

The Scarborough OPP sets environmental performance outcomes (EPOs) for the project and this Petroleum Activity Program, where relevant. EPOs set the level of performance to be achieved, to ensure that environmental impacts and risks will be of an acceptable level and the project is consistent with the principles of ecologically sustainable development.

1.10.3.2 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 respect to offshore petroleum activities in Commonwealth waters, these requirements are implemented by NOPSEMA via the commitments included 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).

1.10.3.3 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 Marine Parks (DNP) is responsible for managing AMP's (supported by Parks Australia), and is required to publish management plans for them. Other parts of the Australian Government must not perform functions or exercise powers in relation to these parks that are inconsistent with management plans (s.362 of the EPBC Act). Relevant AMPs are identified in **Section 4.8** and described in **Appendix H** and the Scarborough OPP**.** The North-west Marine Parks Network Management Plan (DNP, 2018a) and the South west Marine Parks Network Management Plan (DNP, 2018b) describe the requirements for managing the marine parks that are relevant to this EP.

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 though 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 authorized scientific research and monitoring.
- National Park Zone (IUCN category II)—managed to protect and conserve ecosystems, habitats and native species in as natural a state as possible. The zone only allows non-extractive activities unless authorised for research and monitoring.
- Recreational Use Zone (IUCN category IV)—managed to allow recreational use, while conserving ecosystems, habitats and native species in as natural a state as possible. The zone allows for recreational fishing, but not commercial fishing.
- Habitat Protection Zone (IUCN category IV)—managed to allow activities that do not harm or cause destruction to seafloor habitats, while conserving ecosystems, habitats and native species in as natural a state as possible.
- Multiple Use Zone (IUCN category VI)—managed to allow ecologically sustainable use while conserving ecosystems, habitats and native species. The zone allows for a range of sustainable uses, including commercial fishing and mining where they are consistent with park values.

The proposed activity will include works through the Montebello Marine Park Multiple Use Zone. In accordance with the North-west Marine Parks Network Management Plan (DNP, 2018a), petroleum activities including transportation of minerals by pipeline, and oil spill response are permittable subject to approval in Multiple Use Zone (IUCN category VI) and Special Purpose Zone Trawl (IUCN category VI). Proposed mining operations conducted under usage rights that existed immediately before the declaration of a marine park do not require approval.

Petroleum activities (including environmental monitoring in connection with a particular petroleum activity) occurring within these zones are approved by a class approval (DNP, 2018a). Conditions of the Class Approval that are considered relevant to the scope of this EP are provided in **Table 1-3**.

Table 1-3: Conditions of Class Approval relevant to the Petroleum Activities Program

Condition Number	Condition	Relevant Section of the EP
1	The Approved Actions must be conducted in accordance with: (a) an Environment Plan accepted under the Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2009; - (b) the EPBC Act; (c) the EPBC Regulations (d) the North-west Network Management Plan; (e) any prohibitions, restrictions or determinations made under the EPBC Regulations by the Director of National Parks; and (f) all other applicable Commonwealth and state laws (to the extent those laws are capable of operating concurrently with the laws and instruments described in paragraphs (a) to (e)).	Conditions 1a, b, c and f are met by the submitted EP. 1d the impacts on the marine park values have been considered **Section 6.6** and **6.7.** 1e Consultation has been undertaken with the Director of National Parks and no prohibitions, restrictions or determinations have been made (**Section 5**)
2	If requested by the Director of National Parks, an Approved Person must notify the Director prior to conducting Approved Actions within Approved Zones.	**Section 7.13** describes requirements to notify the DNP prior to activities within the Montebello Multiple Use Zone.
3	If requested by the Director of National Parks, an Approved Person must provide the Director with information relating to undertaking the Approved Actions (or gathered while undertaking the Approved Actions), that is relevant to the Director's management of the Approved Zones.	If requested by the Director of National Parks, information relating to undertaking the Approved Actions (or gathered while undertaking the Approved Actions), that is relevant to the Director's management of the Approved Zones will be provided.

Activities will be undertaken in an area adjacent to the Dampier Marine Park, however not within the marine park noting a 250 m buffer is to be maintained. Demonstration that the activities are not inconsistent with the management plans are provided in **Section 6**.

1.10.3.4 World Heritage Areas

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 1-4**.

Table 1-4: 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.	3.01 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 4.8** and considered in the assessment of impacts and risks for the Petroleum Activity in **Section 6**. 3.03 (c): Consultation and feedback received in relation to impacts and risks to the Ningaloo Coast and Shark Bay

Number	Principle	Relevant Section of the EP
	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.	World Heritage Areas (which are both within the scope of this EP) 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.

2. ENVIRONMENT PLAN PROCESS

2.1 Overview

This section outlines the process Woodside follows to prepare the EP once an activity has been defined as a petroleum activity. The process (**Section 2.2**) describes the environmental risk management methodology that is used to identify, analyse and evaluate risks to meet ALARP and acceptability requirements and to develop EPOs and EPSs. This section also describes Woodside's risk management methodologies applicable to implementation strategies applied during the activity.

Regulation 13(5) of the Environment Regulations requires 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 that they can be assessed, and appropriate control measures applied to eliminate, control or mitigate the impact/risk to ALARP and determine if the impact or risk level is acceptable.

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

Planned activities (routine and non-routine) have the potential for inherent environmental impacts. An environmental risk is an unplanned event with the potential for impact (termed risk 'consequence').

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

2.2 Environmental Risk Management Methodology

An assessment of the impacts and risks associated with the Petroleum Activities Program has been undertaken in accordance with Woodside's Environment Impact Assessment Guideline and Risk Assessment Procedure. This guideline and procedure set out the broad principles and high-level steps for assessing environmental impacts across the lifecycle of Woodside's activities and managing these during project execution.

The key steps of the Woodside impact and risk management process are comprised of the:

- environmental impact and risk assessment
- communication and consultation that informs the assessment and ongoing environmental performance of the activity
- steps required during implementation of the activity including to monitor, review and report.

2.2.1 Establish the Context

Context is established by considering the proposed activities associated with a Petroleum Activities Program, and the environment in which the activities are planned to take place.

Describing the activity involves the evaluation of whether the activity meets the definition of a "petroleum activity" as defined in the Environment Regulations. The activity is then described in relation to the location, what is to be undertaken and how - this allows for the identification of environmental **aspects** for each activity.

2.2.2 Review of the Significance/Sensitivity of Receptors and Levels of Protection

Sensitivity of receptors relevant to the Scarborough Project, and this Petroleum Activities Program, was determined during development of the Scarborough OPP. As set out within the Scarborough OPP, the sensitivity of all project receptors, was determined to be either low, medium or high based on qualitative expert judgement.

During development of this EP, Scarborough OPP receptor sensitivity determinations were reviewed in the context of any changing legislation or changed knowledge regarding the sensitivity of each receptor. No relevant factors that would change receptor sensitivity (from that determined in the Scarborough OPP) were identified. Receptor sensitivity determinations from the OPP are used in the risk impact assessment summaries for each environmental risk assessment (refer to **Section 6**).

2.2.3 Environmental Legislation and Other Requirements

In preparing this EP, Woodside has ensured the proposed controls and impact and risk levels are consistent with national and international standards, law and policies (including applicable plans for management and conservation advices, and significant impact guidelines for MNES).

This has included developing the project in accordance with all applicable legislation as identified in **Section 1.10**, and ensuring the requirements of the species recovery plans and conservation advices have been considered to identify any requirements that may be applicable to the risk assessment.

2.2.4 Impact and Risk Identification

Terminology used for this impact and risk assessment has been taken from the impact and risk management process, which is aligned with ISO 13001:2018 and the requirements of Part 2 (Regulations 6 to 25A) of the OPGGS Regulations.

Impacts and risks of the Scarborough Project were identified in the scoping phase of the Scarborough Project (and presented within the Scarborough OPP). During this phase, the relationships between the environmental aspects identified for the proposed activities and the associated potential impacts and risks for each receptor are established. This EP considers relevant impacts and risks associated with the Scarborough Project's Seabed Intervention and Trunkline Installation campaigns.

Using the Scarborough OPP as a guide, all impacts and risks associated with the Petroleum Activities Program for this EP were identified during the EP scoping phase by undertaking an Environmental Risk and Impact Identification (ENVID) workshop 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 ENVID workshop was undertaken by a multidisciplinary team comprising personnel with sufficient breadth of knowledge, training and experience to reasonably assure that the hazards that may arise in connection with the Petroleum Activity Program in this EP were identified

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

2.3 Impact and Risk Analysis and Evaluation

After identifying impacts and risks, analysis and evaluation is undertaken to determine the extent of the impacts and risks, whether they are acceptable or not, and to identify any impact and risk treatment (or controls) to be implemented.

Impact and risk evaluation are undertaken by assessing the magnitude (i.e. no lasting effect, slight, minor, moderate, major or catastrophic) of the credible environmental impacts from each aspect based on extent, duration, frequency and scale, and then either:

- assigning an impact significance level to each credible environmental impact based on the receptor sensitivity and the magnitude of the impact, OR
- assigning an environmental risk level to each environmental risk based on the receptor sensitivity, magnitude of the consequence, and the likelihood of occurrence.

2.3.1 Impact Evaluation

Impact assessment determines the impact significance of the potential impacts, based on the magnitude and the receptor sensitivity (**Figure 2-1**).

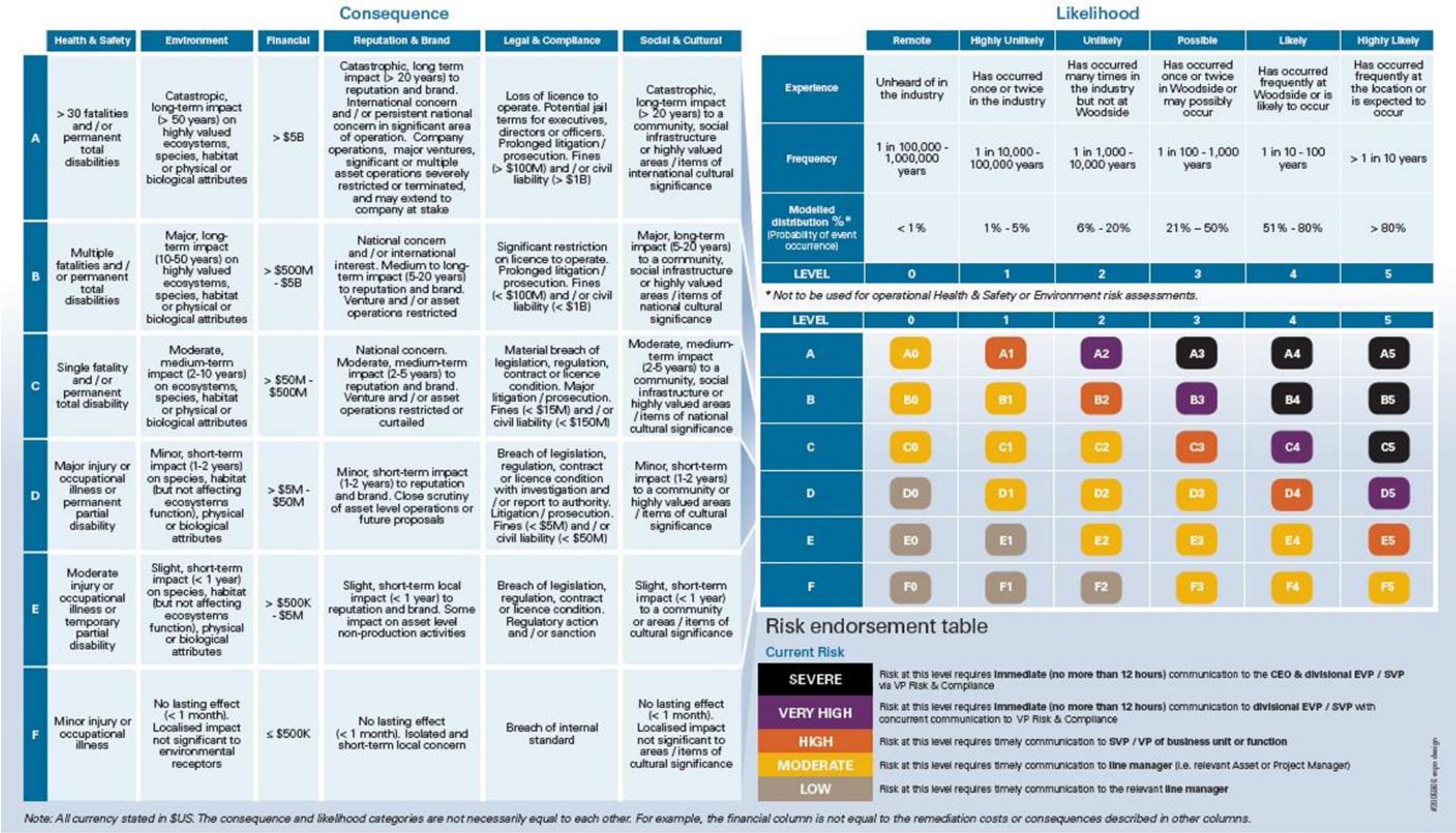
	Receptor Sensitivity		
Magnitude	Low	Medium	High
Catastrophic	B	A	A
Major	C	B	A
Moderate	D	C	B
Minor	E	D	C
Slight	F	E	D
No lasting effect	F	F	E

Significance Level
Catastrophic (A)
Major (B)
Moderate (C)
Minor (D)
Slight (E)
Negligible (F)

Figure 2-1: Impact significance level

2.3.2 Risk Evaluation

In support of ongoing risk management (a key component of Woodside's Process Safety Management Framework – refer to Implementation Strategy (**Section 7**)), Woodside uses the concept of 'current risk' and applies a current risk rating to indicate the current or 'live' level of risk, considering the controls that are currently in place and regularly effective. 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 the communication and visibility of the risk events, and ensures risk is continually managed to ALARP by identifying risk reduction measures and assessing acceptability.



Consequence

	Health & Safety	Environment	Financial	Reputation & Brand	Legal & Compliance	Social & Cultural
A	> 30 fatalities and / or permanent total disabilities	Catastropic, long-term impact (> 50 years) on highly valued ecosystems, species, habitat or physical or biological attributes	> $5B	Catastrophic, long term impact (> 20 years) to reputation and brand. International concern and / or persistent national concern in significant area of operation. Company operations, major ventures, significant or multiple asset operations severely restricted or terminated, and may extend to company at stake	Loss of licence to operate. Potential jail terms for executives, directors or officers. Prolonged litigation / prosecution. Fines (> $100M) and / or civil liability (> $1B)	Catastrophic, long-term impact (> 20 years) to a community, social infrastructure or highly valued areas / items of international cultural significance
B	Multiple fatalities and / or permanent total disabilities	Major, long-term impact (10-50 years) on highly valued ecosystems, species, habitat or physical or biological attributes	> $500M - $5B	National concern and / or international interest. Medium to long-term impact (5-20 years) to reputation and brand. Venture and / or asset operations restricted	Significant restriction on licence to operate. Prolonged litigation / prosecution. Fines (< $100M) and / or civil liability (< $1B)	Major, long-term impact (5-20 years) to a community, social infrastructure or highly valued areas / items of national cultural significance
C	Single fatality and / or permanent total disability	Moderate, medium-term impact (2-10 years) on ecosystems, species, habitat or physical or biological attributes	> $50M - $500M	National concern. Moderate, medium-term impact (2-5 years) to reputation and brand. Venture and / or asset operations restricted or curtailed	Material breach of legislation, regulation, contract or licence condition. Major litigation / prosecution. Fines (< $15M) and / or civil liability (< $150M)	Moderate, medium-term impact (2-5 years) to a community, social infrastructure or highly valued areas / items of national cultural significance
D	Major injury or occupational illness or permanent partial disability	Minor, short-term impact (1-2 years) on species, habitat (but not affecting ecosystems function), physical or biological attributes	> $5M - $50M	Minor, short-term impact (1-2 years) to reputation and brand. Close scrutiny of asset level operations or future proposals	Breach of legislation, regulation, contract or licence condition with investigation and / or report to authority. Litigation / prosecution. Fines (< $5M) and / or civil liability (< $50M)	Minor, short-term impact (1-2 years) to a community or highly valued areas / items of cultural significance
E	Moderate injury or occupational illness or temporary partial disability	Slight, short-term impact (< 1 year) on species, habitat (but not affecting ecosystems function), physical or biological attributes	> $500K - $5M	Slight, short-term local impact (< 1 year) to reputation and brand. Some impact on asset level non-production activities	Breach of legislation, regulation, contract or licence condition. Regulatory action and / or sanction	Slight, short-term impact (< 1 year) to a community or areas / items of cultural significance
F	Minor injury or occupational illness	No lasting effect (< 1 month). Localised impact not significant to environmental receptors	≤ $500K	No lasting effect (< 1 month). Isolated and short-term local concern	Breach of internal standard	No lasting effect (< 1 month). Localised impact not significant to areas / items of cultural significance

Likelihood

	Remote	Highly Unlikely	Unlikely	Possible	Likely	Highly Likely
Experience	Unheard of in the industry	Has occurred once or twice in the industry	Has occurred many times in the industry but not at Woodside	Has occurred once or twice in Woodside or may possibly occur	Has occurred frequently at Woodside or is likely to occur	Has occurred frequently at the location or is expected to occur
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
Modelled distribution %* (Probability of event occurrence)	< 1%	1% - 5%	6% - 20%	21% – 50%	51% - 80%	> 80%
LEVEL	0	1	2	3	4	5

* Not to be used for operational Health & Safety or Environment risk assessments.

LEVEL	0	1	2	3	4	5
A	A0	A1	A2	A3	A4	A5
B	B0	B1	B2	B3	B4	B5
C	C0	C1	C2	C3	C4	C5
D	D0	D1	D2	D3	D4	D5
E	E0	E1	E2	E3	E4	E5
F	F0	F1	F2	F3	F4	F5

Risk endorsement table

Current Risk

SEVERE	Risk at this level requires **immediate (no more than 12 hours)** communication to the **CEO & divisional EVP / SVP** via VP Risk & Compliance
VERY HIGH	Risk at this level requires **immediate (no more than 12 hours)** communication to **divisional EVP / SVP** with concurrent communication to VP Risk & Compliance
HIGH	Risk at this level requires timely communication to **SVP / VP of business unit or function**
MODERATE	Risk at this level requires timely communication to **line manager** (i.e. relevant Asset or Project Manager)
LOW	Risk at this level requires timely communication to the relevant **line manager**

Note: All currency stated in $US. The consequence and likelihood categories are not necessarily equal to each other. For example, the financial column is not equal to the remediation costs or consequences described in other columns.

Figure 2-2: Environmental risk levels

2.3.3 Decision Support Framework

To support the risk assessment process 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 has been applied during the ENVID or equivalent preceding processes during historical design decisions to determine the level of supporting evidence that may be required to draw sound conclusions regarding risk level and whether the risk is ALARP and acceptable. This is to confirm:

- activities do not pose an unacceptable environmental risk
- appropriate focus is placed on activities where the risk is anticipated to be acceptable and demonstrated to be ALARP
- appropriate effort is applied to the management of risks 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 (referred to as Decision Type A, B or C). The decision type is selected based on an informed discussion around the uncertainty of the risk, then documented in ENVID output.

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

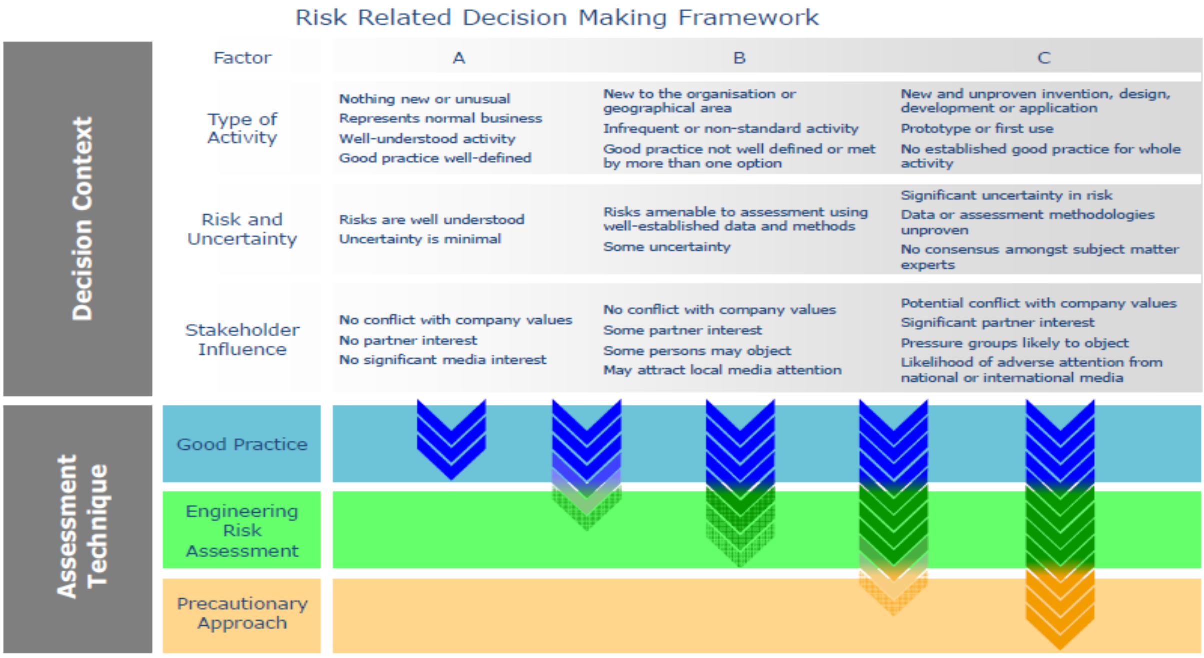


Figure 2-3: Risk related decision-making framework (Oil and Gas UK, 2014)

Decision Type A

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

Decision Type B

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

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

Decision Type C

Risks classified as a Decision Type C typically have significant risks related to environmental performance. Such risks typically involve greater complexity and uncertainty; therefore, requiring 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, 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.

2.3.4 Demonstration of ALARP

Descriptions have been provided below (**Table 2-1**) to articulate how Woodside demonstrates different risks, impacts and Decision Types identified within the EP are ALARP.

Table 2-1: Summary of Woodside's criteria for ALARP demonstration

Risk	Impact	Decision Type
Low and Moderate	***Negligible, Slight, or Minor (D, E or F)***	***A***
Woodside demonstrates these Risks, Impacts and Decision Types are reduced to ALARP if: • controls identified meet legislative requirements, industry codes and standards, applicable company requirements and industry guidelines • further effort towards impact/risk reduction (beyond employing opportunistic measures) is not reasonably practicable without sacrifices grossly disproportionate to the benefit gained.		
High, Very High or Severe	***Moderate and above (A, B or C)***	***B and C***
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.		

2.3.5 Demonstration of acceptability

Acceptability of the Scarborough Project, including the Petroleum Activities Program described in this EP, was demonstrated in the Scarborough OPP (SA0006AF0000002, Rev 5) as required by Environment Regulation 5D (6). The EPOs set in the Scarborough OPP demonstrate that the environment impacts and risks of the project will be managed to an acceptable level.

The impacts and risks of Scarborough were determined to be acceptable in the Scarborough OPP through consideration of the following evaluation criteria (Scarborough OPP (SA0006AF0000002, Rev 5); Section 6.4.4):

- Principles of Ecologically Sustainable Development (ESD) as defined under the EPBC Act
- internal context – the proposed impacts and risk levels are consistent with Woodside policies, procedures and standards
- external context – consideration of the environment consequence and stakeholder acceptability
- other requirements – the proposed controls and impact and risk levels are consistent with national and international standards, laws, policies and Woodside Standards (including applicable plans for management and conservation advices, and significant impact guidelines for MNES)

In this EP Woodside has demonstrated that the level of acceptability determined in the Scarborough OPP has been met through the following criteria:

- Adoption of relevant Scarborough OPP EPOs and controls
- Adoption of EP specific controls where required
- Impact Significance Level / Risk Consequence levels for receptors are equal to or less than the significant impact level defined in the Scarborough OPP (SA0006AF0000002, Rev 5; Section 6.5; Table 6-3) and are therefore consistent with the EPOs and managed to an acceptable level of impact or risk, and
- Consideration of internal/external context and other requirements specific to this EP Petroleum Activities Program (including issues raised during EP Stakeholder Consultation).

A summary of the process as adopted is shown in **Table 2-2**.

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

Risk	Impact	Decision Type
Low and Moderate	***Negligible, Slight, or Minor (D, E or F***	***A***
Woodside demonstrates these Risks, Impacts and Decision Types are 'Broadly Acceptable' if they meet the EP criteria listed above in **Section 2.4.4**. Further effort towards risk reduction (beyond employing opportunistic measures) is not reasonably practicable without sacrifices grossly disproportionate to the benefit gained.		
High, Very High or Severe	***Moderate and above (A, B or C)***	***B and C***
Woodside demonstrates these higher order Risks, Impacts and Decision Types are 'Acceptable if ALARP' if they meet the EP criteria listed above in **Section 2.4.4**. In addition, these higher order risks, impacts and decision types are 'Acceptable if ALARP' 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**). For potential C or above consequence/impact levels where significant uncertainty exists in analysis of the risk or impact (such as, for predicted or potential high risk of significant environmental impacts, significant project risk/exposure, novel activities, lack of consensus on standards, and significant stakeholder concerns. (E.g. Decision Type C), defined acceptable levels and assessment of acceptability may be required to be conducted separately for key receptors.		

2.4 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 1.10.3.2**). The steps in this process are:

- identify relevant listed threatened species and ecological communities (**Section 4.6**)
- identify relevant recovery plans and threat abatement plans
- 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**).

2.5 Environmental Performance Objectives/Outcomes, Standards and Measurement Criteria

The OPGGS Environment Regulations define EPOs to mean: "a measurable level of performance required for the management of environmental aspects of an activity to ensure that environmental impacts and risks will be of an acceptable level". As such, the process of defining an appropriate EPO, has relied on the required levels of performance set either in legislation (such as the OPGGS Act), regulator guidance notes such as the Matters of National Environmental Significance–

Significant Impact Guidelines (DotE, 2013) or may be the result of specific agreements or expectations with other relevant persons (e.g. fishers or other marine users).

EPOs for the Scarborough Project have been set within the Scarborough OPP (SA0006AF0000002, Rev 5) and assessed as meeting the requirements of the Regulations to be appropriate, consistent with the principles of ecologically sustainable development and to demonstrate that the environmental impacts and risks of the project will be managed to an acceptable level.

Environment Plans for petroleum activities submitted subsequent to the Scarborough OPP process are required to contain EPOs that are appropriate by being consistent with those set out in the Scarborough OPP. The EPOs presented in a subsequent EP are not required to be exactly the same however should achieve the same environmental outcome (or better) as that described in the Scarborough OPP. Activity specific EPs will also be required to contain measurement criteria and performance monitoring, auditing and reporting processes relating to the EPOs.

Table 6-1 shows a comparison between EPOs in the Scarborough OPP (SA0006AF0000002, Rev 5) and this EP.

3. DESCRIPTION OF THE ACTIVITY

3.1 Overview

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

3.2 Project Overview

Woodside proposes to undertake seabed intervention and trunkline installation activities along the Scarborough trunkline route. The trunkline route is approximately 435 km from the Pluto LNG onshore facility to the pipeline end termination (PLET), of which about 400 km are in Commonwealth waters. This Environment Plan covers the section of the trunkline in Commonwealth waters from the State waters boundary to the PLET in WA-61-L. All references to trunkline hereafter refer to this section of the trunkline. Specific locations along the trunkline are referred to as Kilometre points (KPs) throughout this EP. These references are indicative until final KPs are determined after Trunkline installation.

Seabed intervention activities include surveys, seabed preparation for installation of the trunkline in the form of trenching, excavation and construction of infrastructure crossing rock berms; and post trunkline installation stabilisation activities. These include trench backfill and rock berm construction over the installed trunkline as well as any pre- and post-lay span supports.

Trunkline installation activities include pre and post installation surveys of the trunkline route, trunkline lay over multiple other operator pipelines and fibre optic cables, in-line installation of a 32”/36” reducer and 32” in-line tee near the Pluto Platform, installation of hot tap tees (after continental slope crossing), installation of the PLET and ancillary structures adjacent to the FPU location. Trunkline pre-commissioning activities include dry-commissioning with nitrogen and contingency for flood, clean, gauge and hydrotest (FCGT).

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

Table 3-1: Petroleum Activities Program Overview

Item	Description
Permit Area	WA-61-L; Pipeline Licence (no. to be confirmed when licence granted)
Location	Carnarvon Basin, North-West Australia
Water depth	Approximately 31 m (trunkline route at State waters boundary) to 1400 m (deepest point at KP 275 of the trunkline route)
Seabed Intervention	
Key Vessels	• Trailing suction hopper dredge (TSHD) • Offshore construction vessel (OCV)/ deep water excavation • Rock installation vessel (RIV) • Survey vessels • Support vessels • Fuel bunkering vessels

Key activities	• Surveys:
	  • Geophysical (including hydrographic surveys)
	  • Geotechnical
	• Pre-, progress and post construction survey (visual and multibeam echo sounder)
	• Trenching along the trunkline route and material disposal at existing Spoil Ground 5A

Item	Description
	• Borrow ground dredging and backfill along the trunkline • Continental slope crossing seabed preparation • Trunkline and infrastructure crossing supports installation, using rock and mattresses • Trunkline pre- and post-lay span rectification • Contingent seabed intervention activities including maintenance dredging/excavation of resettled material in the trench prior to pipelay, post lay dredging, grout bags and rock placement
Trunkline Installation	
Key Vessels	• Pipelay Vessel (PV) • Shallow Water Lay Barge (SWLB) • Anchor handling vessel/tug • Pipe supply vessels • Offshore construction vessel (OCV) • Survey vessels • Fuel bunkering vessels

Key activities	• Surveys:
	  • Pre-lay survey of the trunkline route prior to commencement of pipelay (visual & multibeam echo sounder)
	  • Post-lay as-built survey of the completed trunkline (visual and multibeam echo sounder)
	• Installation of the trunkline by a SWLB in the shallow water section of the route where the DP PV may not be able to access due to water depth restrictions.
	• Setting of SWLB anchors with anchor handling vessel/tug.
	• Installation of the trunkline by the PV including over other resource operator pipelines.
	• Installation of PLET and in-line tee assembly, hot tap tee assembly and ancillary structures as required through design by the PV.
	• Continuous delivery of pipe to the SWLB and PV by pipe supply vessels.
	• Installation of the foundations for the PLET structure by a construction vessel prior to the installation of the PLET.
	• Dry pre-commissioning of the trunkline by a construction vessel.
	• Contingent activities including wet buckle recovery and FCGT.

3.3 Concordance with the Scarborough OPP

The Scarborough OPP describes the scope of the project and its component activities, at a level comprehensive enough to facilitate thorough evaluation of environmental impacts and risks and appropriate setting of EPOs. However, in accordance with NOPSEMA guidance, it is acknowledged that an OPP is prepared at an early stage in project development, before detailed planning of component activities has occurred. More detailed descriptions of the component activities are therefore expected in subsequence EPs.

Refinement or modifications to methods or timing for individual project activities may occur after an OPP acceptance and before the submission of EPs. These refinements or modifications to the accepted project cannot be new activities and cannot significantly change the overall environmental impacts and risks of the project as described in the accepted OPP. **Table 3-2** shows which scopes from the Scarborough OPP may have progressed in level of definition from the time the Scarborough OPP was authored.

Section 4 of the Scarborough OPP (SA0006AF0000002, Rev 5) provides a detailed description of the Scarborough project.

Table 3-2: Concordance of activities described in the Scarborough OPP with those included in this EP

Scarborough OPP Section	Scope or overview of the Activity	Relevance to this EP	Refinement or modification to methods	Refinement or modification to timing	Is this a new activity	Significance of change
4.4.2.4 Trunkline	In the Scarborough OPP it is proposed that gas from the Scarborough fields will be exported from the FPU via a 32-inch carbon steel trunkline.	As Trunkline engineering has progressed post Scarborough OPP acceptance, optimisation has resulted in a dual diameter design. This EP describes and assesses installation of a Trunkline with nominal 36" diameter from state waters boundary to approximately KP200 (offshore, approx. 194m water depth, before the Continental Slope crossing). From KP 200 to the FPU (approx. KP 433) the Trunkline remains nominal 32" diameter.	Yes	No	No	This change does not significantly alter the overall environmental impacts and risks of the project as described in the accepted Scarborough OPP. The dual diameter Trunkline increases contingent hydrotest (FCGT) discharge volumes however risk assessment shows no significant change in environmental impact potential (**Ref 6.6.8**). There is no increase in seabed disturbance from the larger diameter due to the relatively small absolute change (i.e. 2" increase in nominal diameter of Trunkline) (**Ref 6.6.3**) There are no changes required to the emission estimates provided in the OPP (Section 7.1.3.2) as a result of the proposed change to the trunkline diameter.
4.4.8 Pre-commissioning and Commissioning	While dry pre-commissioning is the base case for Trunkline pre-commissioning, the Scarborough OPP described and assessed the risks and impacts associated with hydrotest (FCGT). Potential volume of pre-commissioning discharges were estimated as 190,000 m^3 of chemically treated seawater with a 20% contingency, resulting in a	Planning and design of the contingent FCGT activity has progressed since Scarborough OPP development and the FCGT pre-commissioning activity could occur as: • Approx. 255,000 m^3 discharge of Trunkline fluids at PLET. Discharge occurs twice, due to the	Yes	No	No	This change does not significantly alter the overall environmental impacts and risks of the project as described in the accepted Scarborough OPP. Impact assessment carried out (**6.6.8**) shows the highest impact significance level remains as Slight (E) with no new receptors outside of the EMBA.

Scarborough OPP Section	Scope or overview of the Activity	Relevance to this EP	Refinement or modification to methods	Refinement or modification to timing	Is this a new activity	Significance of change
	maximum likely volume of 223,000 m^3. Assumptions were made when modelling the discharge, such as a discharge rate of approx. 1500m^3/hr. The location and timing of the pre-commissioning fluid discharge was unknown; however, was assumed to be discharged from a single point on the seabed in the vicinity of the proposed location of the FPU at any time of the year.	need to pre-flood the Trunkline to manage pig speed and air ingress risks (maximum total discharge of wet pre-commissioning fluids at PLET location approx. 510,000 m^3). • Approx. 30,000 m^3 discharge of pre-flooding / hydrotest fluid around in Commonwealth waters near the State Waters boundary). Discharge occurs twice, resulting in maximum total discharge of wet pre-commissioning fluids for the first approx. 33km of Trunkline of approx. 60,000 m^3. Wet pre-commissioning discharges will be separated by at least 72hrs (between discharge of the pre-flood / FCGT fluids) such that water quality returns below 99% species protection level, as supported by hydrotest discharge modelling, and as such there is no cumulative impact potential for benthic receptors.				With the inclusion of a possible discharge in Commonwealth waters near the State waters boundary there is no increase in risk and no new receptors.
4.4.7.3 Trunkline Stabilisation –	Displaced material from continental slope preparation could be placed in the vicinity of the pipeline route	Method selection of the continental slope crossing preparation activity has	Yes	No	No	This change does not significantly alter the overall environmental impacts and risks of the project as

Scarborough OPP Section	Scope or overview of the Activity	Relevance to this EP	Refinement or modification to methods	Refinement or modification to timing	Is this a new activity	Significance of change
continental slope crossing	(within a radius of approximately 250m) and/or relocated along the pipeline corridor.	progressed since Scarborough OPP. Excavated material from continental slope preparation is planned to be placed in areas adjacent to the pipeline route 100 m to 500 m from the trunkline centreline either side. In the case of free vessel navigation (a potential method of preparation), material placement location may be up to 1 km from the trench centre line.				described in the accepted Scarborough OPP. The overall impact significance level for disturbance to benthic habitat from trunkline installation and associated activities is Minor (D) based on a minor impact to the most sensitive receptors (marine fauna, AMPs and KEFs) (**Ref 6.6.3**). The impact significance levels for individual receptors are consistent with the levels rated in the Scarborough OPP.
Throughout	Different dates are proposed throughout the OPP for various project phases. For example Section 4.4.2.4 describes Trunkline construction as anticipated to begin in 2022.	Project timing (as detailed in **Section 3.6** of this EP) has changed, for example Trunkline installation in Commonwealth Waters may commence Q4 2023. This is due to the 2020 delay in project progress.	No	Yes	No	This change does not significantly alter the overall environmental impacts and risks of the project as described in the accepted Scarborough OPP. This EP assesses risks across the year, to accommodate changes in timing and ensure risks are managed to ALARP and acceptable levels whenever the activities may be carried out.

3.4 Location

The Petroleum Activities Program is located in Commonwealth waters. **Figure 3-1** shows the trunkline route, Spoil Ground 5A and the Offshore Borrow Ground.

Option selection for the trunkline route is described in Section 4.5.4.5 of the Scarborough OPP (SA0006AF0000002, Rev 5). The trunkline will run from the Pluto LNG onshore facility (Pluto Train 2) to the FPU at the Scarborough field. Within Commonwealth waters, the trunkline will extend from the existing Pluto offshore infrastructure to the FPU at KP 435. From Mermaid Sound to about KP 160, about 20 km south east of the platform, the trunkline will be routed adjacent to the existing Pluto trunkline. At KP 200, about 20 km north-west of the Pluto Riser Platform, the trunkline deviates to the south to avoid the existing facilities and manage environment, technical and safety risks.

The Offshore Borrow Ground within Commonwealth waters is approximately 17 km^2, located 20 km to the east of the proposed trunkline route and is adjacent to the Dampier Marine Park, although offset by a minimum of 250 m from the park boundaries.

Table 3-3: Approximate location details for the Petroleum Activities Program including all relevant infrastructure

Site/Location	Kilometre Point (KP)	Water depth (approx. m)	Coordinates (GDA 94 MGA Zone 50)		Legal Instrument
			Eastings	Northings	
Proposed trunkline route	32 (State waters boundary)	39.3	468970	7749701	Pipeline Licence
	50	44	452864	7756347	
	100	56	404648	7768982	
	150	74	356299	7779977	
	200	193	314711	7794938	
	250	1352	270981	7812935	
	300	1337	224872	7811768	
	350	1114	183660	7785046	
	400	1028	135524	7795563	
	433 (PLET)	941	105629	7793941	
Borrow Ground	NA	35	486549	7755564	Pipeline Licence
		37	485680	7756145	
		38	483677	7756140	
		39	485670	7757795	
		39	486769	7757810	
		39	489553	7758355	
		35	491221	7757228	
		35	492892	7756109	
		33	493711	7755568	
Spoil Ground 5A	N/A	31	467790	7749597	Pipeline Licence
		39	465702	7751758	
		37	464779	7752425	
		37	463738	7752873	
		44	452362	7755535	
		44	452294	7755243	
		38	463301	7752667	
		37	463604	7752596	
		37	463670	7752581	
		36	464629	7752166	
		39	465505	7751567	
		37	466550	7750486	
		36	467508	7749494	

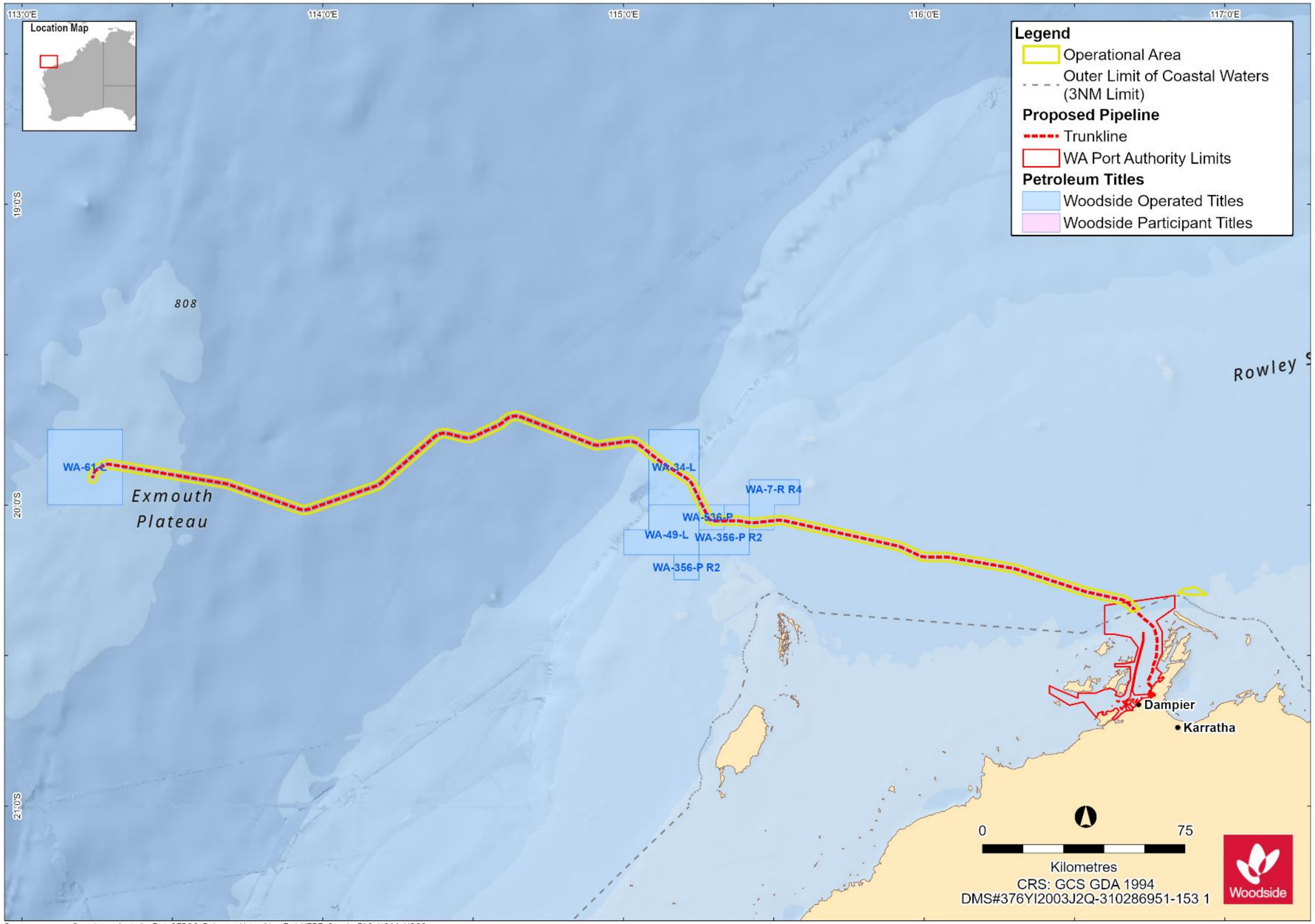


Figure 3-1: Location of the Petroleum Activities Program

3.5 Operational Area

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

For the purposes of this EP, the Operational Area includes the following Project Areas:

- **Trunkline Project Area**: The proposed trunkline from around KP 32 (Commonwealth – State Boundary) to KP 435 and 1.5 km either side of the proposed trunkline centreline which allows for the movement and positioning of vessels and includes Spoil Ground 5A.
- **Offshore Borrow Ground Project Area:** Offshore Borrow Ground located in Commonwealth waters.

This EP refers to the above areas as ‘Trunkline Project Area’ and ‘Offshore Borrow Ground Project Area’. Where the assessment in this EP relates to both these areas, collectively they are referred to as ‘Operational Area’. The Operational Area is shown in **Figure 3-1**.

Vessel-related activities within the Operational Area will comply with this EP. Vessels supporting the Petroleum Activities Program when outside the Operational Area must adhere to applicable maritime regulations and other requirements. This EP applies to activities undertaken within the Operational Area, as described in this section.

3.6 Timing

Subject to relevant approvals and other constraints such as vessel availability and weather, subsea intervention activities are expected to start in Q4 2022. Trunkline installation activities in Commonwealth waters are expected to commence Q4 2023 following successful completion of the State waters installation scope. The Petroleum Activities Program is estimated to be completed in 24 months with activities occurring in multiple campaigns.

Table 3-4 provides a breakdown of the estimated duration of planned seabed intervention and trunkline installation activities. The EP has risk assessed these activities throughout the year (all seasons) to provide operational flexibility for schedule changes and vessel availability.

When underway, activities will be 24 hours per day, seven days per week. Concurrent operations may occur, with timing of some subsea intervention and trunkline installation activities overlapping in-field. There is also a possibility of trunkline activities, such as PLET installation, occurring at the same time as drilling and completions (which will be carried out under a separate EP) and in the vicinity. Timing, duration and vessel selection for all activities is subject to change due to project schedule requirements, vessel availability, unforeseen circumstances, and weather.

Table 3-4: Summary of Petroleum Activities Program timing

Activity	Earliest start & Estimated duration[1]	Vessel (typical)[2]
Pre-lay Seabed Intervention		
Continental slope crossing seabed preparation	Q4 2022 - 1 month	BOKA Falcon (OCV)
Pipeline and infrastructure crossing supports installation	Q4 2022 – 1-2 months	FPV Seahorse (RIV)
Pre-lay span rectifications (rock and/or mattress)	Q1 2023 - 1 week	BOKA Falcon and FPV Seahorse
Pre-lay trenching and spoil disposal	Q2 2023 - 2 months	TSHD Gateway
Trunkline Installation		
Pre-lay survey of the trunkline route	Q3 2023 – 1 month	Survey vessel
Trunkline installation including in-line tee and PLET	Q3 2023 – 1 month Q4 2023 – 6 months	Saipem Endeavour (SWLB) Saipem Castorone (PV)

Activity	Earliest start & Estimated duration[1]	Vessel (typical)[2]
	Q1 2024 – 1 month	Construction vessel for PLET foundation installation
Dry pre-commissioning	Q2 2024 – 1 month	Construction vessel
Post-lay survey of the installed trunkline	Q2 2024 – 1 month	Survey vessel
Post-lay Seabed Intervention (incl. all progress surveys)		
Borrow ground dredging and backfill	Q4 2023 – 2-3 months	TSHD Gateway
Post-lay installation of rock for stabilisation and/or span rectification	Q3 2024 – 2-3 months	FPV Seahorse

[1] Does not account for operational delays and is an estimate of timeframes required for the activity
[2] Indicative vessels only, may be subject to change based on availability

3.7 Vessel Operations

Several vessel types will be required to complete the activities associated with the Petroleum Activities Program. These are detailed in **Table 3-1** and **Table 3-3**.

Vessels may mobilise from an Australian port or directly from international waters to the Operational Area, in accordance with biosecurity and marine assurance requirements. Vessels will not usually anchor within the Operational Area during the activities and instead maintain position using DP.

DP uses multiple sources of positioning data (such as satellite navigation and radio transponders) to maintain the position of the vessel at a required location. In some instances, higher levels of accuracy may be required, where satellite information is enhanced via seabed transponders. These transponders emit signals that are detected by receivers on the vessel and used to calculate position. The transponders are typically deployed in an array on the seabed, using clump weights comprising concrete. They are recovered at the end, generally by ROV, and clump weights will also be recovered.

All vessels will display navigational lighting and external lighting, as required for safe operations. Lighting levels will be determined primarily by operational safety and navigational requirements under relevant legislation, specifically the *Navigation Act 2012*. The vessels will be lit to maintain operational safety on a 24-hour basis.

3.8 Support Operations

3.8.1 Refuelling

Vessels will be refuelled via support vessels as required and with a dedicated bunker vessel for the PV given its size. Refuelling may take place within the Operational Area and has been included in the risk assessment for this EP. For the SWLB and PV refuelling will take place within the Operational Area during continuous trunkline installation. Other fuel transfers that may occur on board vessels may include refuelling of cranes or other equipment as required.

3.8.2 Helicopter Operations

Helicopter activities are not planned for the Seabed Intervention scope, however there may be situations where a crew changes may be performed using helicopters where vessels have a helideck. Helicopter operations within the Operational Area are limited to helicopter take-off and landing on the helideck.

For the trunkline installation scope helicopters will be used to transfer crew to and from the SWLB, PV and construction vessel on a regular basis, potentially up to six days per week. For vessel locations further along the trunkline route (i.e. past the nominal location of Pluto platform) the helicopters will be refuelled on the helideck. As such this activity will take place within the Operational Area and has been included in the risk assessment for this EP.

3.8.3 ROV Operations

The vessels may be equipped with a ROV system that is maintained and operated by specialised personnel aboard the vessel. ROVs may be used during activities including:

- Visual observations at seabed during activities (e.g., rock berm installation and continental slope preparation) and monitoring of the touch down point of the trunkline on the seabed during trunkline installation.
- Pre and post lay surveys using an ROV, which can be fitted with various tools and camera systems.

3.8.4 Underwater Acoustic Positioning

Accurate positioning of mattresses, rock berms, the Trunkline and other structures on the seabed is required and therefore Ultra Short Baseline (USBL) and/or Long Base line (LBL) acoustic positioning may be required in some instances.

Typically, USBL subsea transponders are mounted on an ROV or structure which transmits an acoustic pulse back to the vessel receiver, hence providing an accurate position.

The LBL array provides accurate positioning by measuring ranges to three or more transponders deployed at known locations on the seabed and structures. These transponders will be recovered at the end of the petroleum activities. Alternatively, LBL transponders may be moored to the seabed by a clump weight which are recovered by means of a hydrostatic release. Clump weights will also be recovered.

Transmissions are not continuous but consist of short ‘chirps’ with a duration that ranges from 3 to 40 milliseconds. Transponders will not emit any sound when on standby. When required for general positioning they will emit one chirp every five seconds (estimated to be required for 4 hours at a time). When required for precise positioning they will emit one chirp every second (estimated to be required for 2 hours at a time).

3.9 Seabed Intervention Activities

3.9.1 Surveys

Survey activities may be carried out prior to the commencement of seabed intervention, during scope execution and after the activity is complete. Surveys may collect data to gather information on:

- bathymetry
- debris/obstacles
- pipeline and infrastructure (fibre optic cables etc.) crossings
- spoil ground and borrow ground conditions
- trunkline position.

The survey activities are undertaken either from a dedicated survey vessel or from the construction vessels themselves (RIV using its ROV for example).

The survey methods may include multibeam echo sounders (MBES), side scan sonar (SSS), pipe trackers, magneto meter and sub bottom profiler (SBP), and may utilise LBL or USBL for positioning. The survey methods used will be dependent on seabed soil conditions and required penetration and resolution. Some of the systems act as the transmitter and receiver; others have a separate transmitter and a short hydrophone streamer as a receiver.

MBES is used to undertake hydrographic surveys prior to, during and post trenching, material disposal and offshore borrow ground dredging activities. The purpose of the surveys is to establish seabed levels of the dredging areas, monitoring progress during dredging, material disposal and backfill.

MBES, like other sonar systems, transmit sound energy and analyse the return signal (echo) from the seafloor or other objects. The sound waves are transmitted from a transducer mounted on the hull of the survey vessel to produce a fan-shaped coverage of the seafloor. The coverage area on the seafloor depends on the equipment used, the settings of the equipment and the depth of the water.

SSS, pipe trackers and magneto meters may be used to verify positions of existing seabed features and infrastructure such as fibre optic cables, pipelines, umbilicals or seabed/subsurface obstacles.

Additional small-scale geotechnical surveys may be undertaken to support seabed preparation activities. Geotechnical surveys typically involve in-situ testing and piston/push sampling. Following sampling, all equipment is withdrawn from the seabed. A small hole (<1 m²) will remain, which will eventually collapse and infill with the movement of surface sediments in ocean current.

3.9.2 Vessel Operations

3.9.2.1 Trailing suction hopper dredge (TSHD)

Trenching, material disposal and sand backfill activities associated with the Petroleum Activities Program will be undertaken by trailing suction hopper dredge (TSHD). TSHDs are a self-propelled ship with a holding facility ('hopper') and are generally equipped with one or two suction pipes connected to drag head(s). The TSHD includes an overflow to discharge the redundant water overboard.

Typical TSHD vessel parameters are presented in **Table 3-5**.

Table 3-5: Typical TSHD vessel parameters

Parameter	Description – Example TSHD Gateway
Draft	10 m
Length	143.5 m
Carrying capacity	12,000 m^3
Total fuel volume	1590 m^3
Volume of largest fuel tank	287 m^3
Drag heads / suction pipes	Single

3.9.2.2 Rock Installation Vessel (RIV)

Installation of rock berms (**Section 3.9.6.1**) associated with the Petroleum Activities Program will use a dynamically positioned rock installation vessel. These vessels have the major equipment and systems of:

- flexible fall pipe and fall pipe ROV assisting with highly accurate rock placement (low rock wastage)
- fall pipe ROV with full video and multibeam echosounder capability
- large rock carrying capacity to ensure limited transfers to restock
- fully integrated production data monitoring systems ensuring efficient execution
- DP2 dynamic positioning station keeping capability and redundancy.

Typical RIV parameters are presented in **Table 3-6**.

Table 3-6: Typical rock installation vessel parameters

Parameter	Description - Example FPV Seahorse
Draft (max)	8 m
Length	162 m
Carrying capacity	17,500 t
Total fuel volume	3161 m^3
Volume of largest fuel tank	1270 m^3

3.9.2.3 Offshore Construction Vessels (OCVs)

Continental slope crossing seabed preparation (**Section 3.9.5**), span rectification (**Section 3.10**) and concrete mattress placement (**Section 3.9.6.2**) will be performed by a construction vessel under seabed intervention scope. Construction vessels will use DP and have a large heave compensated crane, work class ROVs and large flat back deck space to perform the works.

Typical construction vessel parameters are presented in **Table 3-7.**

Table 3-7: Typical construction vessel parameters

Parameter	Description – Example BOKA Falcon
Draft (max)	7.8 m
Length	93.4 m
Gross tonnage	6776 t
Crane capacity (AHC)	150 t @ 12 m
Total fuel volume	1,339 m^3
Volume of largest fuel tank	461 m^3

3.9.2.4 Support and other vessels

Other vessels used for the Seabed Intervention Activities include survey vessels, fuel bunkering and support vessels. These are smaller vessels than those detailed above.

Support vessels will be used to transport equipment and materials between the activity vessels and port (e.g., Dampier, Onslow). The loading and back-loading of equipment, materials and wastes is one of the most common supporting activities conducted. Loading and back-loading is undertaken using cranes on the vessels to lift materials in appropriate offshore rated containers (e.g., ISO tanks, skip bins, containers) between the activity vessel and support vessel. The support vessels, when in the Operational Area, are also available to assist in implementation of the Oil Pollution First Strike Plan, should an environmental incident occur (e.g., spills).

3.9.3 Trunkline Trenching (Dredging and Material Disposal)

It is anticipated that for the section of trunkline from shore to ~KP 50 in Commonwealth waters, there may be a requirement for some trenching (pre-lay) and back fill (post-lay) to stabilise the trunkline in both State and Commonwealth waters.

The pre-lay trenching works associated with the trunkline installation involves the dredging of an approximately 2–3.5 m deep trench, with an average width of approximately 30 m along the trunkline route, for ~18 km into Commonwealth waters, with detailed engineering being undertaken to minimise these intervention works as far as practicable. Up to approximately 0.8 Mm^3 of sediment will be required to be trenched in Commonwealth waters (in the case of trenching from KP 32 to KP 50).

A TSHD has been proposed for the pre-lay trenching works in Commonwealth waters. TSHDs are a self-propelled ship with a holding facility ('hopper') and are generally equipped with one or two suction pipes connected to drag head(s). Once near the trenching area the TSHD will be positioned along the centreline of the trench. The TSHD will then lower its trailing pipe and attached drag head to the seabed. The TSHD will sail slowly forward (typically 1-1.5 m/s) while dragging the drag head along the seabed. A jet system is typically used to assist with fluidising the seabed material whilst the drag head teeth provide some cutting/loosening influence. The dredge pumps hydraulically lift the mixture of solids and water up the suction pipe and into the hopper.

The loading of the TSHD will be optimised using overflow. Overflow is the release of predominantly water with some fine sediment and is used to maximise the quantity of sediment within the hopper and as such dredged material within each load. Overflowing generally starts once the sediment mixture reaches the top of the overflow weir in the hopper and would typically continue until the hopper is loaded to the dredging mark. Overflow will be discharged at the keel level rather than above water to reduce turbidity and dispersal of fine sediments.

The TSHD will place the dredged material in an approved spoil ground area in accordance with an approved Sea Dumping Permit (SD2019-3982). Spoil Ground 5A is the nominated spoil ground in Commonwealth waters, which lies within the Trunkline Project Area. Spoil Ground 5A is approximately 300 m wide and runs for about 18 km between the State waters boundary and a maximum of KP 50. Spoil Ground 5A has previously been used for spoil disposal from the Pluto Foundation trunkline. A total volume of up to approximately 0.8 Mm^3 trenched material may be disposed of within Spoil Ground 5A.

3.9.4 Offshore Borrow Ground Dredging and Backfill

After the installation of the trunkline in the trench, backfilling with dredged material is required to help stabilise the trunkline. Up to ~2 Mm^3 of this material will be sourced from the Offshore Borrow Ground, within Commonwealth waters for placement in both Commonwealth and State waters.

Up to approximately 0.9 Mm^3 (in the case of backfill from KP 32 to KP 50) of sandy sediments with a low proportion of fines will be required to help stabilise the trunkline in Commonwealth waters. Backfill material will be dredged using a TSHD in the same method presented in **Section 3.9.3**.

Backfill material obtained from the Offshore Borrow Ground will be placed over the trunkline via a drag head. The TSHD will reverse pump the sand backfill material from its hopper into the trench through a suction pipe such that material is released close to the seabed. When backfilling the trunkline some trench overflow may be required to ensure the specifications for stabilisation are met.

Offshore Borrow Ground is the only borrow ground considered within Commonwealth waters (**Figure 3-1**) and is considered within the Petroleum Activities Program and the scope of this EP. Operations within this borrow ground will have a 250 m buffer from the boundary of the Dampier Marine Park.

3.9.5 Continental Slope Crossing Seabed Preparation

The trunkline along the continental slope requires seabed preparation to prevent excessive bending movements in the trunkline and associated free span lengths, where excavation will take place in water depths ranging between 550 m and 650 m. At about KP 209, seabed material, over a length of approximately 150 m within a 300 m corridor (excluding placement), will be excavated and/or displaced, which will allow appropriate pipeline span lengths.

The volume for excavation is dependent on trench depth and side slope angles. The design of the trench is significantly influenced by geotechnical properties and long-term stability requirements. The excavation volume is indicated as between 5000 and 15,000 m^3.

The primary method of excavation is planned to be undertaken using an ROV controlled large volume grab. This system will be deployed from the construction vessel with an active heave compensated crane and lowered to the seabed. Several options for lateral movement of the excavated material are considered:

- use of a winch connected to a clump weight, offset from pipeline centreline
- use of a connected hose system to the grab, allowing a pump inside the grab to pump the mixture through the hose to a point above the bucket or to a designated placement area
- by vessel navigation moving the construction vessel between excavated area and adjacent material placement location for each grab cycle.

Selection of the most suitable, or combination of method(s) is subject to detailed engineering in context of the local soils and confirmation of a stable permanent side slope angle. Given the low strength of the local soil the creation of overburden on the top of the side slope is reviewed in significant detail. Typically, the seabed footprint for the disposal of excavated material is 100 m to 500 m from the trunkline centreline either side. In case of the free navigation of the construction vessel the choice of material placement location may be up to 1 km from the trench centre line.

Secondary options to achieve the excavation profile are methods such as: mass flow excavation, conventional ROV tooling and/or jetting to create the required trench. All the proposed methods will involve a level of fluidisation of the already very soft soils in the trench profile. This is unavoidable given the soil properties. A portion of the material excavated will end up dispersed in the water column with particles settling out away from the excavated area as a result of current and gravity, typically moving material down gradient.

3.9.6 Pipeline and Infrastructure Crossing Supports

The trunkline route crosses existing subsea infrastructure including pipelines, flexible flowlines, umbilicals and fibre optic cables, which will require this installation crossing supports (**Table 3-8**). The design and specifications of the crossing supports will be specific to each crossing. The options for possible crossing supports include rock berms (**Section 3.9.6.1**) and concrete mattresses (**Section 3.9.6.2**). Three infrastructure crossings lie within the Montebello Marine Park Multiple Use Zone (MUZ) (**Figure 3-2**).

Table 3-8: Commonwealth waters subsea infrastructure crossings

Crossing	KP	Water depth (m)	Method
Reindeer Pipeline (Santos)	75	~ 51 m	Rock
Fibre Optic Cable 1 (Telstra)	136	~71 m	Rock
Fibre Optic Cable 2 (Telstra)	150	~ 75 m	Rock
Wheatstone Pipeline (Chevron)	190	~ 121 m	Rock
Julimar Brunello Pipeline	192	~ 135 m	Rock
Pluto Pipeline	194	~ 150 m	Rock
Pyxis Pipeline	212	~1005 m	Mattresses

3.9.6.1 Rock Berms

Crossing supports may use rock berms upon which the trunkline is subsequently installed, to clear the existing infrastructure. The rock berms at the beginning and end of each crossing will contain rock cover over the top of trunkline. The rocks will be placed on the seabed in a controlled manner using a dynamically positioned RIV.

A test dump may be carried out prior to crossing support installation, to sure up RIV and equipment configuration. This would be carried out within the Trunkline Project Area in a location free from existing infrastructure and not within the direct line of the trunkline route.

The direct disturbance footprint will be determined by the length, number and height of the rock berms. Seabed disturbance associated with the rock berms will typically be within the 30 m average disturbance corridor for the trunkline installation activities, however some settling of material may occur wider than 30 m and the corridor may extend slightly further for the centre of the berm.

Pre-lay supports to control acceptable trunkline spanning require the design to consider maximum allowable span lengths, working out whether one or multiple supports are required. Seabed bathymetry is a key input to assess to most appropriate locations for the supports. Where the span height is minimal, concrete mattresses may be used (**Section 3.9.6.2**).

A dynamically positioned RIV will be used to install the rock on the seabed. The fall pipe consists of multiple pipe sections, allowing it to be adjusted for water depth. The rock is transported from the hoppers along conveyor belts to the fall pipe and a feeder is used to control the installation rate. The fall pipe guides the material to the seabed and an ROV located at the base of the fall pipe allows for positioning.

Rock may be sourced locally and/or internationally.

3.9.6.2 Concrete Mattresses

Some crossing and span supports may consist of concrete mattresses, likely in areas of soft sediments. Concrete mattress would be installed on either side of the existing subsea infrastructure. Typical concrete mattresses are 6 or 8 m x 3 m; however, they could be larger and will be dependent on final design and seabed topography. The concrete mattresses will be installed from a DP construction vessel. The vessel's crane will be used to lift the concrete mattress from the deck of the vessel and then lowered to the seabed. An ROV will be used during installation to assist placement and positioning on the seabed.

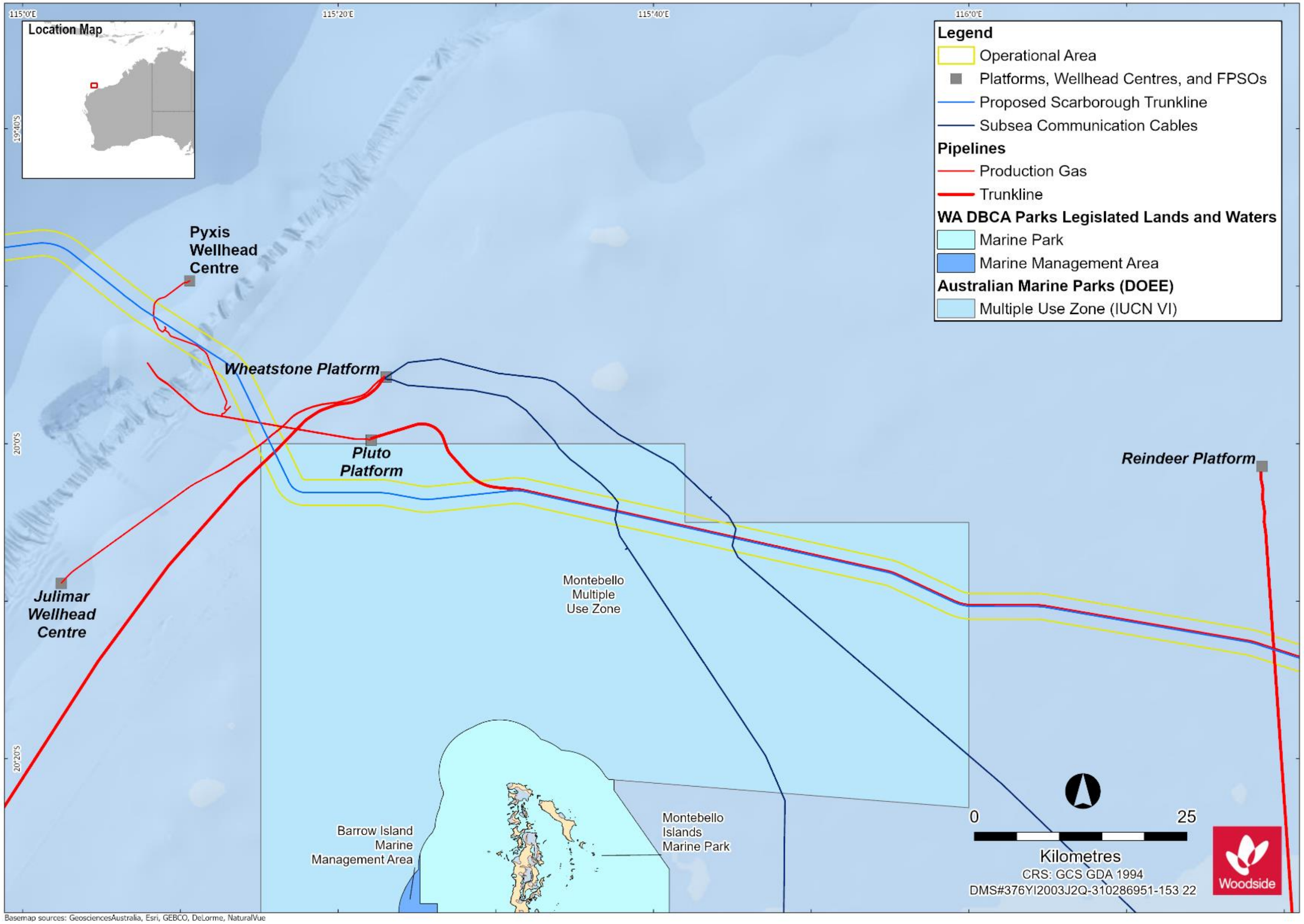


Figure 3-2: Pipeline and infrastructure crossings requiring protection

3.10 Span Rectification

The trunkline route has been engineered to reduce the requirement for span rectification. Currently, it is anticipated that only one location will require pre-lay span correction; however, further design and the pre-lay survey will confirm the final number of pre-lay span corrections required. Following installation of the trunkline, additional locations requiring span rectification may be identified.

The options for possible span correction (pre and post lay) and scour mitigation include concrete mattresses (typically 6 or 8 m x 3 m) (**Section 3.9.6.2**), grout bags (typically 200 kg to 2000 kg) (**Section 3.10.1**), rock installation (**Section 3.9.6.1**), seabed levelling and excavation (e.g. dredging using TSHD, mass flow excavators and jetting) (**Section 3.12.7**).

3.10.1 Grout Bags

Grout bags are typically used to correct spans after trunkline installation. This process typically involves placing grout bags under the span section. The empty bag is moved into position using ROV, then filled with grout supplied from a mixing and pumping spread on the construction vessel via a downline. Small, prefilled bags can be installed using ROV or lowered to the seabed using a vessel crane. Following installation activities, concrete lines and equipment may be flushed clean, with wash-water discharged overboard.

Typical grout volumes depend on the size of the span and may vary in weight from about 200 kg to 2000 kg per span.

3.11 Trunkline Installation Activities

3.11.1 Surveys

Survey activities may be carried out prior to the commencement of trunkline installation (pre-lay), during scope execution (touch down monitoring) and after trunkline installation has occurred (post-lay). Surveys may collect data to gather information on:

- bathymetry
- debris/obstacles
- pipeline and infrastructure (fibre optic cables etc.) crossings that the trunkline will be installed over
- the finished trunkline position.

The survey activities are undertaken either from a dedicated survey vessel or from installation vessels themselves, using the ROV stationed onboard these vessels.

A pre-lay survey of the trunkline will be undertaken prior to commencement of installation. This survey is aimed at identifying debris and other hazards prior to laying the trunkline and is not considered a full geophysical/geotechnical survey.

The survey usually utilises a SSS fish towed behind the pre-lay survey vessel. The survey methods are non-intrusive and the equipment, under planned operation, will not disturb the seabed. Information is transferred to the survey vessel via an umbilical. The pre-lay survey may also be undertaken with ROV or Autonomous Underwater Vehicle (AUV) using SSS.

An unexploded ordnance survey (UXO) may also be performed by the survey vessel at this time to confirm the trunkline route is free of any historic ordinances.

An MBES, a common survey tool for offshore surveys, may also be deployed to establish the profile of the seabed, using sound pulses.

Touch down monitoring survey will be performed throughout the duration of the trunkline installation to regularly confirm that the trunkline is being installed to the design tolerances. This will be performed by visual inspection from ROVs from either the SWLB or PV, or a dedicated survey vessel for the deep-water sections of the trunkline.

An as-laid survey will be performed after installation of the trunkline to inform the design of the backfill and post-lay rock dumping profiles and confirm the trunkline has been correctly installed prior to the commencement of pre-commissioning. These surveys will gather data on the position of the trunkline and the need for any additional span rectification.

An as-built survey will be performed on the fully completed trunkline to provide the baseline as-left condition of the trunkline. Surveys will use a combination of MBES and ROV visual inspection of the trunkline by inspecting the full length of the completed trunkline.

3.11.2 Vessel Operations

3.11.2.1 Shallow Water Lay Barge

A Shallow Water Lay Barge (SWLB) will be required for the installation of the nearshore section of the trunkline, up to around the State waters boundary, however activities with this vessel may extend into Commonwealth waters. Typical specifications of a SWLB are provided in **Table 3-9**.

The SWLB will be positioned using up to ten anchors, and forward movement of the SWLB to lay the trunkline will be achieved by continually repositioning the anchors with anchor handling tugs. Anchors may be placed up to ~800 m either side of the SWLB. The SWLB position during operations will be closely monitored and existing infrastructure will be considered when assessing the barge anchor patterns.

Table 3-9: Specifications of a typical SWLB

Properties	Description – example Saipem Endeavour
Vessel length	143.3 m
Vessel width	42 m
Draft	Minimum 4 m / maximum 6.38 m
Number of tensioners	2 x 75 t
Maximum A/R winch tension	150 t
Volume of largest fuel tank	375 m^3

The SWLB will be assisted throughout pipelay operations by a spread nominally comprising of the following vessels:

- Two anchor handling tugs for mooring operations.
- Two shallow water tugs for mooring PV in very shallow water areas.
- Survey vessel for monitoring of the touch down point of the trunkline.
- Two pipe supply vessels.

  These vessels may move into Commonwealth waters (and work within the Operational Area covered under this EP) as they carry out activities close to the State waters boundary.

Anchor holding tests may be performed to ensure anchor requirements of the SWLB can be met. If an anchor is found to be dragging, the tension in the anchor wire will be released and remedial action in the form of redeployment and/or re-tensioning will be undertaken.

3.11.2.2 Pipelay Vessel

The Pipelay Vessel (PV) will install the trunkline in State and Commonwealth waters. The nominated vessel is the Saipem Castorone. Details of the PV are provided in **Table 3-10**. Installation will commence with recovery of the trunkline laid by the SWLB at around KP 31 (possibly out to about KP 33) in approximately 30 m water depth. The PV will maintain position during pipelaying operations using dynamic positioning.

The PV will be supported by a spread of pipe supply vessels, survey vessel and general supply vessels.

Table 3-10: Specifications of the PV

Properties	Description example - Castorone
Length	330 m (excluding ramp/stinger and helideck)
Width	39 m
Operational draft	Minimum 8 m, Maximum 10.6 m
Transit draft	8 m
S-lay stern ramp	120 m long hinged stinger
Number of tensioners	3 x 400 t
Maximum A/R winch tension	1200 t
Volume of largest fuel tank	1683 m^3

3.11.2.3 Pipe Supply Vessel or DP Bulk Carrier

Pipe supply vessels or DP Bulk Carriers (in the case of the PV) will transport 12 m lengths of pipe from a mothership moored in State waters, to the SWLB and PV. DP Bulk Carriers are also known as B-types for this PAP, and two are currently planned for use. These will cycle between the PV and the mothership and may be refuelled near the PV in-field. The B-type has a removable, automated, pipe-handling gantry crane and 5,700m^2 of total deck space.

Table 3-11: Specifications for a typical DP2 B-type

Parameter	Description example - Spliethoff DP2 B-type
Length	141.30 m
Width	24.50 m
Draft (open top)	7.85 m
Engines	5,300 kW Main Engine, 4 x 2,000 kW Auxiliary Engines
Fuel consumption	Service speed 15 mt/day or DP2 15-16 mt/day
Volume of largest fuel tank	250 m^3

3.11.2.4 Construction Vessel

A construction vessel is planned to be used to install the PLET foundation and perform pre-commissioning of the trunkline. The construction vessel will use DP and have a large heave compensated crane, work class ROVs and large flat back deck space to perform the works.

Typical construction vessel parameters are presented in **Table 3-12**.

Table 3-12: Typical construction vessel parameters

Parameter	Description
Draft (max)	7 m
Length	95 m
Gross tonnage	6000-7000 t
Fuel type	Marine diesel
Total fuel volume	1339 m^3
Volume of largest fuel tank	461 m^3

3.11.2.5 Support and Other Vessels

Other vessels used for the Petroleum Activities Program include survey vessels, anchor handling (for the SWLB), fuel bunkering and support vessels. These are smaller vessels than those detailed above.

Support vessels will be used to transport equipment and materials between the activity vessels and port (e.g., Dampier, Onslow). The loading and back-loading of equipment, materials (including hazardous materials such as helicopter fuel, welding gases and chemicals for field joint coating) and wastes is one of the most common supporting activities conducted. Loading and back-loading is undertaken using cranes on the vessels to lift materials in appropriate offshore rated containers (e.g., ISO tanks, skip bins, containers) between the activity vessel and support vessel. The support vessels, when in the Operational Area, are also available to assist in implementation of the Oil Pollution First Strike Plan, should an environmental incident occur (e.g., spills).

3.11.3 Trunkline Installation

The trunkline is dual diameter with the diameter between the state waters boundary and ~KP 200 (approximately adjacent to the Pluto platform) being 36” and the remainder of the trunkline to the FPU being 32” diameter for a total route length of approximately 400 km in Commonwealth waters.

The key routing drivers for the trunkline are:

- minimising environmental impact
- avoiding any identified geohazards
- finding an optimum route up the continental slope (1000 m to 300 m water depth) which minimises intervention requirements and long-term integrity issues
- minimising the number of third-party trunkline crossings.

The shallow water section of the trunkline will be installed by a SWLB due to the water depth being under 30 m deep, which prevents access by the PV. The SWLB will construct the trunkline by welding together nominal 12 m lengths of pipe in the SWLB’s firing line (a series of work stations where welders weld the pipes together) and laying them to the seabed over the “stinger”, which supports the trunkline as it transitions from the SWLB to the seabed. As the pipes are 12 m long the SWLB moves forward 12 m at a time as each pipe joint is welded into the trunkline. Depending on the handover point between the SWLB and the PV, the SWLB may need to lay into Commonwealth waters.

Most of the trunkline will be installed from the multi-joint PV suitable for the high productivity required for 400 km of pipelay, and capable of laying through the deepwater sections of the trunkline route. Like the SWLB, the PV allows for welding together nominally 12 m lengths of pipe, each new section being welded to the previous section to form the trunkline. To operate at high productivity, the PV includes three firing lines. In two parallel firing lines three 12 m pipes are welded together to form 36 m long triple joints. These triple joints are then transferred into the main firing line where they are welded together to construct the trunkline. Upon completion of welding; inspections and repairs or amendments are carried out as required and field joint coating applied, before the pipe is laid over a “stinger” on the stern of the vessel, down to the seabed. A tensioning system, consisting of three tensioners, holds the trunkline in the PV and allows the trunkline to be laid at the desired rate while maintaining the required tension as each new pipe-section is welded into the trunkline and the vessel moves forward. The welding together of the 36 m long triple joints means the PV moves forwards 36 m at a time enabling it to install the trunkline three times faster than the SWLB.

3.11.3.1 Buoyancy Removal

The trunkline will be installed by the SWLB with buoyancy attached to the individual pipes close to the handover location to the PV. This installation aid is required to reduce the submerged weight of the trunkline as it is installed by the SWLB at ~30 m water depth.

Prior to recover of the trunkline by the PV, the buoyancy will need to be removed. This will be performed by a support vessel which will activate releases to release the buoyancy from the trunkline. The buoyancy will be tethered together to facilitate collection by the support vessel.

3.11.3.2 Pipe and Structure Delivery to the SWLB and PV

During installation of the trunkline, pipe will be continuously delivered to the SWLB and PV by pipe supply vessels or DP bulk carriers. These vessels will be loaded with pipe from traditional cargo vessels moored in State waters and deliver the pipe to the SWLB and PV in the field. These vessels use DP to keep station alongside the SWLB and PV as they lay. During this time the pipe onboard is transferred by lifts using the crane onboard the SWLB and PV, usually with two lengths of 12 m pipe being transferred at a time. Pipe is planned to be transferred daily, allowing for continuous welding and laying of the trunkline.

Fabricated structures such as abandonment and recovery heads and the in-line tee, will also be delivered to the SWLB and PV respectively during the installation campaign from pipe supply vessels or DP bulk carriers. Similar to pipe transfer, these vessels will use DP to keep station alongside the SWLB and PV while the structures are lifted across by the cranes on the SWLB and PV.

3.11.3.3 Laying in Trenches

During trunkline installation near the State waters boundary, the PV will install the trunkline within excavated trenches prepared by the Seabed Intervention scope. Following trunkline installation these trenches will be backfilled by the Seabed Intervention scope.

3.11.3.4 Laying over Existing Infrastructure

During trunkline installation the PV will install the trunkline over the pre-installed rock berms constructed by the Seabed Intervention scope. This will enable the trunkline to clear the existing infrastructure (pipelines and fibre optic cables) with the required vertical clearance.

3.11.3.5 Laying Down Continental Slope

During trunkline installation the PV will install the trunkline down the continental slope in the section excavated by the Seabed Intervention scope.

3.11.3.6 In-line Tee, Hot Tap Tees, ancillary structures

An in-line tee, the two hot tap tees, foundations and ancillary structures or installation aids may be installed by the PV - the structures are welded into the trunkline during the normal lay process. These structures may need to be worked on (intervention) at a later date, by a construction vessel. This may include but not be limited to operation of valves and diverless connector, removal of yokes and buoyancy and installation of scour mattresses.

3.11.4 PLET and foundations Installation

Prior to installation of the PLET by the PV, foundations to support the PLET will be installed by a construction vessel with a heave compensated crane and work class ROVs. The PLET structure is too large to install through the firing line of the PV. As such when the PV reaches the end of the trunkline route adjacent to the FPU location, it will lay down the trunkline in its normal pipelay mode (S-lay) to the seabed. In order to then install the PLET, the trunkline will be recovered by the PV vertically and hang off the side of the vessel in a purpose-built hang-off porch. Here the PLET structure will be lowered down vertically on top of the trunkline by a mechanical A-frame and welded to the trunkline. Following completion of the welding, NDE and field joint coating, the PLET (now connected to the trunkline) will be lifted out of the hang-off porch and lowered to the seabed by a winch system on the PV and landed on top of the pre-installed foundation.

Following installation of the PLET by the PV, the PLET may need to be worked on (intervention) by the construction vessel. This may include but not be limited to operation of valves and diverless connector, removal of yokes and buoyancy and installation of scour mattresses.

3.11.5 Trunkline Pre-commissioning

Pre-commissioning of the trunkline will be performed to prove the trunkline integrity. Pre-commissioning may be undertaken using one of the following methods:

- Dry pre-commissioning (base case)
- Flood Clean Gauge Test – Full Trunkline (contingent scenario)

In addition, a hybrid method of the above may be considered. In the hybrid scenario the nearshore section of the Trunkline in State waters would be subject to FCGT and then be dewatered and dried (discharge into Commonwealth waters, no planned discharges in State Waters). The offshore section of the trunkline in Commonwealth waters would then be installed under the dry pre-commissioning method with the entire completed trunkline dried and inerted at the completion of installation. Only under rare circumstances, if installation of the Commonwealth section of the Trunkline compromised integrity, would the full Trunkline then be wet tested. Dry pre-commissioning is the preferred option and is considered the base case for pre-commissioning. However, this EP also includes the option of wet pre-commissioning with the potential for hydrotest discharges in Commonwealth waters.

3.11.5.1 Dry Pre-commissioning (base case)

This is the basis for the project where the integrity of the Trunkline is proven via the quality control process used during design, manufacture, construction and installation. This includes consideration of activities such as coating of the pipe, transport to the field and installation where the welding NDE is a key deliverable. This method does not include hydrotesting (and any associated discharges); the Trunkline is installed dry and remains dry. At the completion of installation, the Trunkline is dried (of small volumes of condensation) and inerted with nitrogen. As a result, dry pre-commissioning results in no liquid discharge and a reduction in equipment and time.

Dry pre-commissioning will be performed by the construction vessel at the PLET location. A down line from the construction vessel will be connected to the PLET and nitrogen will be flowed through the trunkline to shore to remove small volumes of condensation and then leave the trunkline in an inerted state. Nitrogen will be generated by a drying and inerting spread on the construction vessel which includes a Nitrogen Membrane Unit. To perform this scope the construction vessel ROVs will need to intervene on the PLET which may include the placement of work baskets on the seabed for storage of ROV tools.

3.11.5.2 Cleaning and Gauging Pigging

Cleaning and gauging pigging may be performed in support of the dry-commissioning philosophy. The purpose of cleaning and gauging is to remove contaminating substances such as mill scale, welding products, dust, dirt and salts, and to gauge the trunkline to locate and identify defects such as dents, debris or other internal restrictions prior to dry pre-commissioning. Cleaning and gauging will be performed using pigs propelled from the onshore temporary pig launcher with compressed air with a combination of freshwater slugs to clean the trunkline. Included in this pig train would be a calliper gauging pig that can gauge the dual diameter of the installed trunkline. This activity is only associated with dry pre-commissioning, and results in small discharges of treated water (the slugs between pigs, around 250 m^3).

3.12 Contingent Activities

3.12.1 Flood, Clean, Gauge, Test and Dewater

This is the traditional method for proving integrity and involves conventional flooding, cleaning, gauge and hydrotesting (FCGT also known as wet testing or hydrotesting).

Pre-flooding of the Trunkline with treated seawater will occur, to help manage integrity of the FCGT flooding operation (pig speed and air ingress), and reduce the likelihood of a failed hydrotest. This volume is then discharged while the Trunkline is being flooded for the FCGT using pigs.

Cleaning and gauging pigs would then be run from an onshore temporary pig launcher connected to the shore head to an offshore pig receiver located in Commonwealth waters. Flooding and cleaning pigs would be propelled using filtered and chemically treated seawater using an onshore pumping spread. Flooding water would be supplied by a temporary water winning line installed to provide sea water to the onshore pumping spread.

Once flooded, the trunkline would be pressurised using positive displacement pumps from the onshore shore crossing location. Hydrotesting would then be performed to measure the pressure within the trunkline over an extended period of time. Following completion of the test, the trunkline would be depressurised from onshore and left filled with treated seawater.

Dewatering of the trunkline would be performed using pigs propelled by compressed air with a combination of freshwater slugs to desalinate the trunkline. The displaced hydrotest water will be discharged offshore through a valve arrangement at the end of the Trunkline. Drying and inerting would then be performed and the Trunkline would be left nitrogen filled until hot commissioning.

Activities at the discharge location will be performed with the construction vessel and may include, but not be limited to, intervention on the PLET (attachment of a pig receiver), which could release small volumes of monoethylene glycol (MEG) used to inert the cavity between the PLET valve and diverless connector, and placement of work baskets on the seabed for storage of ROV tools.

3.12.2 Wet Buckle Response

A wet buckle is an event that could occur during trunkline installation and is typically caused by a loss of station keeping of the SWLB or PV and results in the trunkline buckling at the touch down point on the seabed causing it to flood with seawater. To recover from this scenario the damaged section of the trunkline will need to be removed and the remaining good section of trunkline dewatered.

The damaged section of trunkline will be cut from the remainder of the trunkline using equipment such as a diamond wire saw and moved out of the trunkline route. Using a contingency dewatering spread kept in place at the shore crossing location within the Pluto Gas Plant, the trunkline will be dewatered from shore to offshore. The dewatering spread includes pumping equipment that will push pigs through the trunkline from shore to displace the seawater from the trunkline. Upon completion of this activity, the trunkline is recovered to the PV and installation activities will continue. A wet buckle may result in a requirement for subsequent cleaning of the trunkline and associated discharges. The damaged section of the trunkline will then be cut into recoverable lengths (nominally 12 m joints) and recovered by a construction vessel.

3.12.3 Trunkline Abandonment and Retrieval

The trunkline may need to be abandoned and recovery during the course of installation. This could be multiple times. Abandonment is typically required when the sea states exceed the approved limit for trunkline installation, or due to an issue with supply of pipe to the vessel, mechanical issues or approaching cyclone. Abandonment is performed by welding an abandonment head to the trunkline, connected to the abandonment winch and then opening the tensioners and carefully lowering the trunkline to the seabed. Recovery is the reverse of this operation. Abandonment needs to be performed in a straight line, therefore if an abandonment occurs at a bend in the trunkline route, lay-down on the seabed may move outside of the original/expected trunkline footprint. It is important to note here that the catenary of trunkline to be abandoned to the seabed is nominally 2.5 times the water depth.

3.12.4 Retrieval of Lost Buoyancy Tanks

The use of buoyancy tanks during pipelay activities will include redundancy so that loss of a certain number of buoyancy tanks can occur without compromising the operation. In the unlikely event of disconnection of a buoyancy tank, it will be recovered by a tug or support vessel.

3.12.5 Temporary Mooring of Trunkline Installation Vessel

The PV may be required to temporarily moor on location via its anchor, in the case of a contingency scenario. This would be done away from subsea assets to prevent damage. Under normal operations the vessel operates under DP.

3.12.6 Wet Parking Equipment

Equipment, materials or tools may need to be wet parked on the seabed in the Operational Area during installation of the trunkline. This could include, but not be limited to, work baskets for ROV tools, pig launcher/receiver prior/after connection to the PLET, scour mattresses etc. Any wet parked items will be removed from the seabed.

3.12.7 Jetting and Mass Flow Excavation

Jetting and/or mass flow excavation may be used during the trunkline installation for span rectification. These activities would be performed from a construction vessel.

3.12.8 Pre-lay Removal of Obstructions

In the event the pre-lay survey of the trunkline route identifies any obstructions that may impact the trunkline installation, these obstructions will need to be removed. This will be performed by a construction vessel using ROVs and heave compensated crane.

3.12.9 Dead Man Anchor pipelay initiation

In the remote event that the nearshore section of the trunkline in State waters is not installed prior to the arrival of the PV, a Dead Man Anchor (DMA) will be used to initiate trunkline installation. This involves setting the DMA on the trunkline route with a long pennant wire connected to the first pipe of the trunkline in the PV. The DMA is required to provide tension (by the PV pulling on the DMA wire) as the trunkline is laid to the seabed. After a sufficient length of the trunkline has been installed the DMA and associated pennant wire will be removed.

3.12.10 Maintenance of Trenches and Rock Berms

In case pre-lay trenches are silting up prior to pipelay (due to a storm/cyclone event, delays to pipelay or other causes) secondary dredging of settled material in trench may need to occur to reprofile the trench to design utilising the TSHD, with the associated dredged material placed in Spoil Ground 5A.

In the continental slope excavation area, reprofiling may also be required in case slumping/deterioration of the trench profile has occurred over time. It is anticipated that the same equipment would be deployed which carried out the original excavation activity, but depending on the nature and size of the work required a smaller locally available unit (Mass Flow Excavator [MFE], ROV tooling, etc) may be sufficient to carry out the work.

The infrastructure crossing rock berms are designed to withstand severe weather events. However, if in the unlikely case the berms do require rework, this would likely be executed with the RIV, adding some rock volume to reinstate berm height, width or slope angles.

3.12.11 Deburial

In case of faults (or suspected faults) found in the as-constructed trunkline in any section where the pipeline has been buried (after sand or rock placement), the burial material may need to be removed to allow inspection and possible repair of the suspect area. Methods considered for this work in Commonwealth waters are typically MFE, jetting, grab systems or (partial) re-dredging with the TSHD. Spoil would be deposited in the designated Spoil Ground 5A (in case of TSHD intervention) or remain close to the pipeline alignment (all other methods).

3.12.12 Remediation Work

Re-dredging or removing of misplaced sand backfill may be required in case spoil disposal occurred outside the spoil dump area or erroneous placement of rock material and it was decided in coordination with relevant stakeholders that additional intervention is the correct response. Remediation could take the form of application of an MFE attempting to move material away from the offending position, use of a grab system to relocate or re-dredging with the TSHD.

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 relevant values and sensitivities of the environment, which were used for the risk assessment.

The Environment that May Be Affected (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 derived from three key locations. The Hydrocarbon EMBA is also used to define the EMBA (**Figure 4-1**), which includes the dredging Zone of Influence (**Section 6.6.2)**. The ecological impact thresholds used to delineate the EMBA are defined in **Section 6.7.1** The worst-case credible spill scenario for this EP is loss of marine diesel during a vessel collision. The EMBA also includes any areas that are predicted to experience shoreline contact with hydrocarbons above threshold concentrations.

Woodside recognises that hydrocarbons may be visible beyond the EMBA at lower concentrations than the ecological impact thresholds defined in **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. The EMBA and socio-economic EMBA are shown in **Figure 4-1** and **Figure 4-2** and described in **Table 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, with release from three key locations.

This EP also refers to a Zone of Influence (ZoI) associated with seabed disturbance from seabed intervention and pipelay activities. The ZoI is defined in **Section 6.6.2** and is located within the EMBA.

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

<table>
<tr><th>Hydrocarbon Type</th><th>EMBA[1]</th><th>Socio-cultural EMBA[1]</th><th>Planning Area for Scientific Monitoring</th></tr>
<tr><td>Surface</td><td>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.</td><td colspan="2">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).</td></tr>
<tr><td>Dissolved</td><td colspan="2">50 ppb</td><td>10 ppb</td></tr>
</table>

<table>
<tr><th>Hydrocarbon Type</th><th>EMBA[1]</th><th>Socio-cultural EMBA[1]</th><th>Planning Area for Scientific Monitoring</th></tr>
<tr><td></td><td colspan="2">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.</td><td rowspan="2">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 contacted by hydrocarbons at this threshold.</td></tr>
<tr><td>Entrained</td><td colspan="2">100 ppb
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.</td></tr>
<tr><td>Shoreline</td><td>100 g/m^2
This represents the threshold that could impact the survival and reproductive capacity of benthic epifaunal invertebrates living in intertidal habitat.</td><td>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.</td><td>N/A</td></tr>
</table>

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

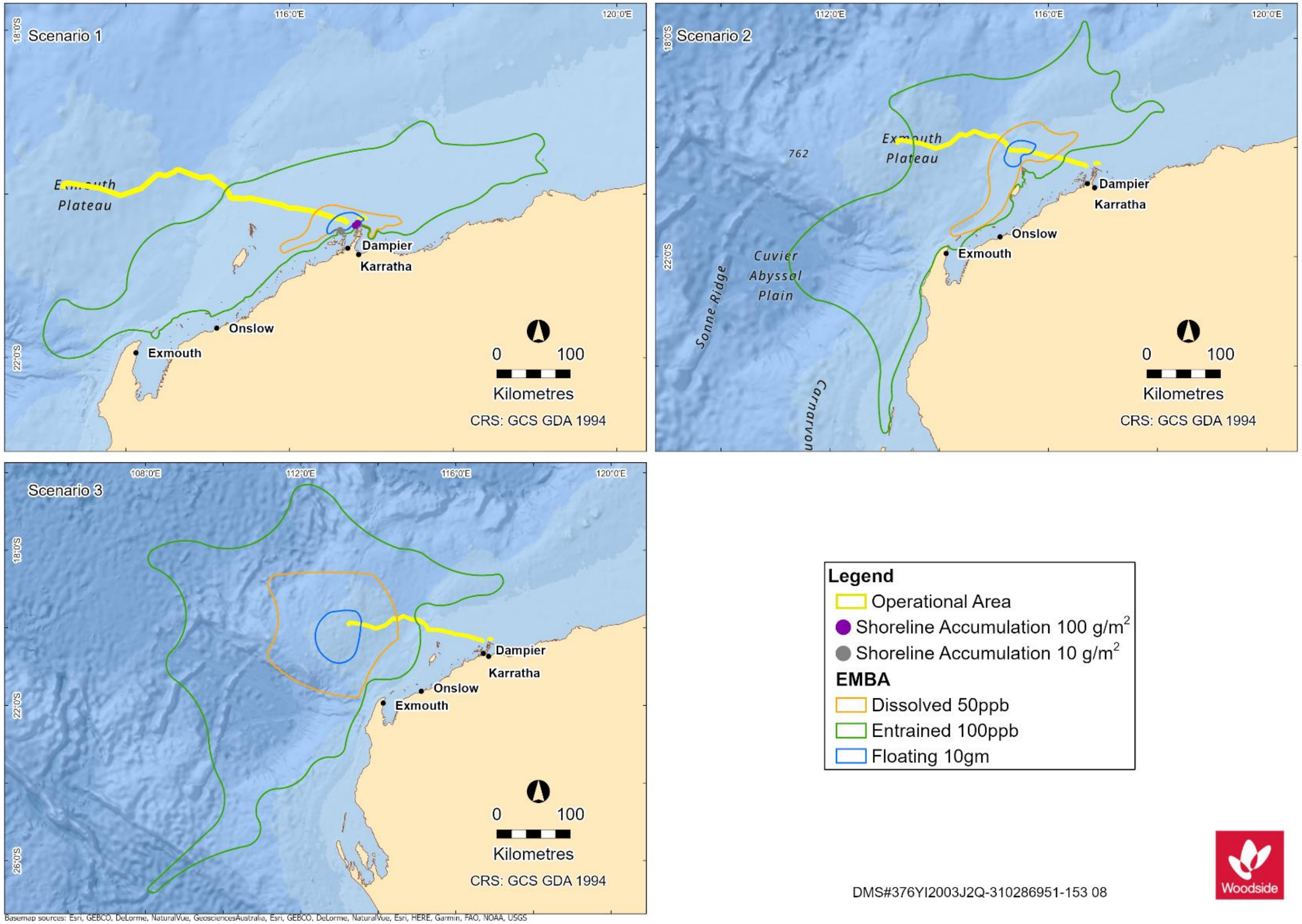


Figure 4-1: Hydrocarbon thresholds used to define the EMBA

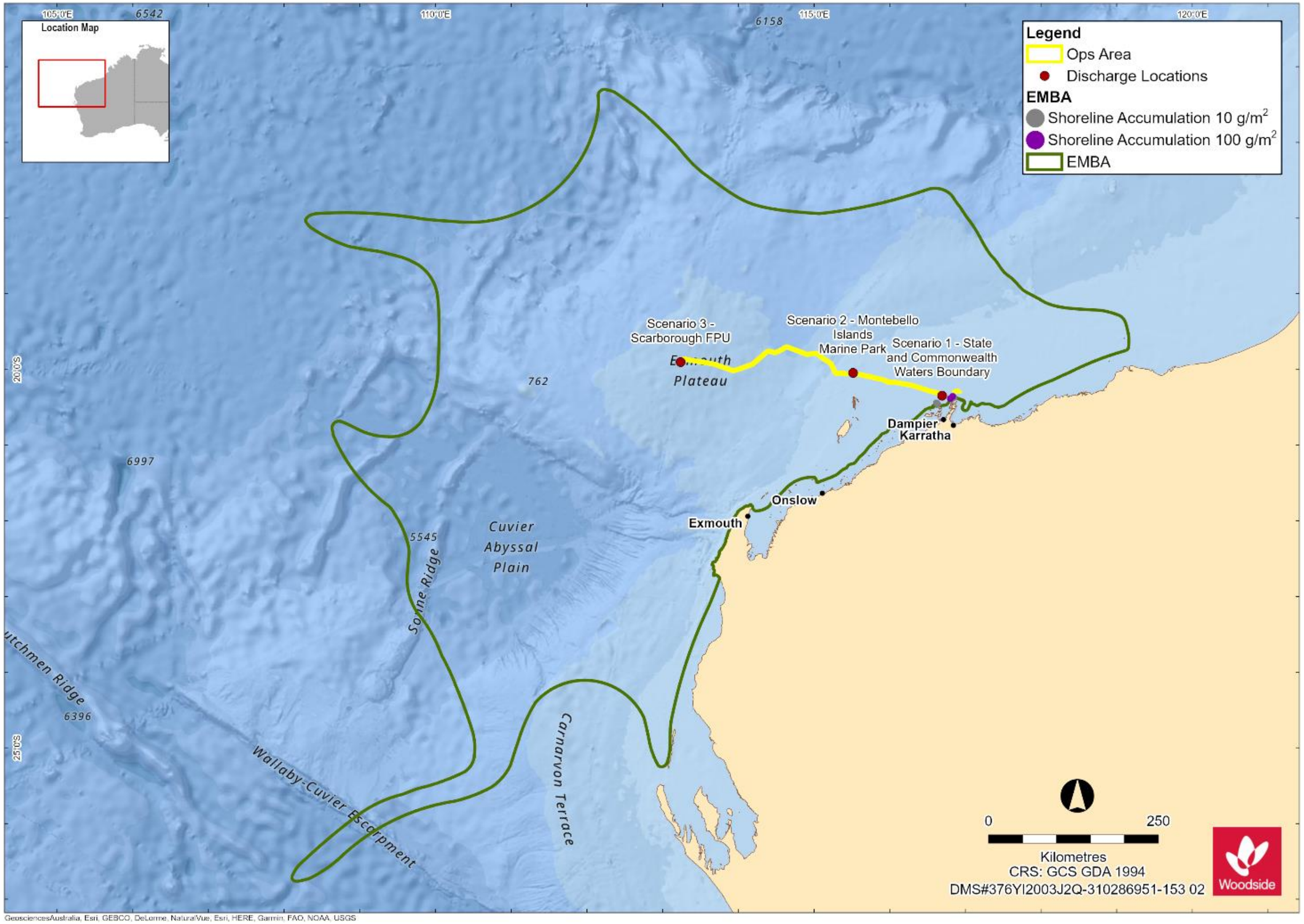


Figure 4-2: Environment that may be affected by the Petroleum Activities Program

4.2 Regional Context

The Operational Area is located in Commonwealth waters within the North-west Marine Bioregion (NWMR), as defined under the Integrated Marine and Coastal Regionalisation of Australia (IMCRA v4.0) (Commonwealth of Australia, 2006), in water depths of ~31 m (trunkline route at State waters boundary) to 1400 m (KP 275 of the trunkline route). The Operational Area overlaps a number of provincial bioregions within the NWMR; the Northwest Shelf Province (NWSP) and the Northwest Province (NWP). The Zone of Influence (ZoI) associated with dredging and pipelay activity is situated within the NWSP. The EMBA also overlaps the Northwest Transition (NWT), the Central Western Shelf Transition (CWST), and the Central Western Province (CWP) (**Figure 4-3**). Section 2.2 in Woodside's Description of the Existing Environment in **Appendix H** and the Scarborough OPP summarise the key characteristics for these marine bioregions.

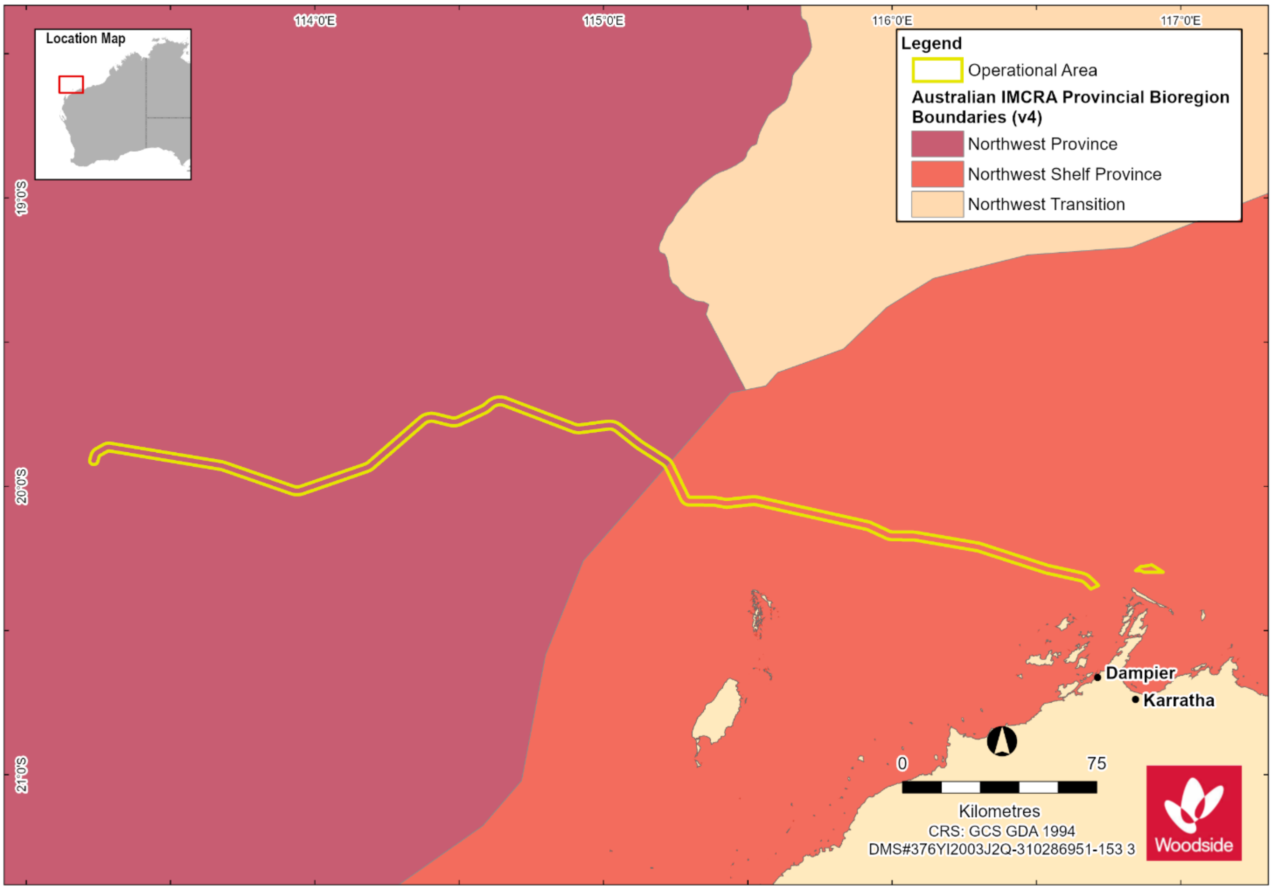


Figure 4-3: Location of the Operational Area and relevant marine bioregions

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 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** and the Scarborough OPP.

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	Relevant Section
World Heritage Areas	0	4.9.1
National Heritage Places	0	4.9.1
Wetlands of International Importance (Ramsar)	0	4.9.1
Commonwealth Marine Area	1	4.9.1
Listed Threatened Ecological Communities	0	4.5
Listed Threatened Species	23	4.6
Listed Migratory Species	39	4.6

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

MNES	Number	Relevant Section
World Heritage Areas	2	4.9.1
National Heritage Places	3	4.9.1
Wetlands of International Importance (Ramsar)	0	4.9.1
Commonwealth Marine Area	2	4.9.1
Listed Threatened Ecological Communities	0	4.5
Listed Threatened Species	39	4.6
Listed Migratory Species	64	4.6

4.4 Physical Environment

4.4.1 Climate and meteorology

The Operational Area and wider EMBA are reflective of the climatic conditions of the NWMR, experiencing a monsoonal climate and maximum average air temperatures of 39.5°C in summer and 15.6°C in winter. Rainfall is highest during the wet season in late summer, and extremely low during winter (dry season). Seasonal wind patterns in the NWMR are dictated by atmospheric pressure, with prevailing winds from the north-west and south-west in the summer, and from the north-east and south-east in the winter. Tropical cyclone activity occurs between November to April, peaking between December and March. **Appendix H** and the Scarborough OPP provide a detailed description of the climate and meteorological conditions for the region (**Table 2-3, Appendix H**), and the Scarborough Area (**Table 2-5, Appendix H**).

4.4.2 Oceanography

The ocean temperatures in the NWMR are tropical year round, with sea surface temperatures reaching ~26˚C (open shelf) and ~31°C (nearshore) in summer and ~22°C (open shelf) and ~17°C (nearshore) in winter. The NWMR is heavily influenced by major surface currents flowing poleward, including the Indonesian Throughflow (ITF), Leeuwin Current, South Equatorial Current, and the Eastern Gyral Current. Seasonal surface currents are also present in the region, including the Ningaloo Current, Holloway Current, Shark Bay Outflow and the Capes Current. Sub-surface currents flow towards the equator, including the Leeuwin Undercurrent and West Australian Current.

Appendix H and the Scarborough OPP provide a detailed description of the oceanographic conditions for the NWMR region (**Table 2-3, Appendix H**), and the Scarborough Area (**Table 2-5, Appendix H**).

4.4.3 Bathymetry, geomorphology and sedimentology

The geological history of the region has influenced the complex geomorphology and sedimentology of the NWMR. Water depths reach to 6000 m, however over 40% of the region features water depths of less than 200 m. The NWMR is described as an extensive area of shelf, slope, abyssal plain and deep ocean floor, with complex geomorphic features. These include plateaus, terraces, banks, canyons and a number of banks and reefs located on the outer shelf/slope. The continental shelf features sand and gravel sediments, that are replaced by mud and fine soft sediments on the continental slope. The abyssal plain is characterised by non-carbonate mud.

The bathymetry of the EMBA is characterised by continental shelf/slope, abyssal plain, canyons, terraces and reefs and sediments are representative of the wider region (**Figure 4-4**).

4.4.3.1 Trunkline Project Area

The Trunkline Project Area extends from the State-Commonwealth waters boundary on the inner continental shelf, onto the continental slope where it traverses the continental slope westwards to the Exmouth Plateau. The eastern half of the Trunkline Project Area is adjacent to the existing Pluto trunkline. The water depth ranges from ~31 m (trunkline route at State waters boundary) to 1400 m (KP 275 of the trunkline route).

Table 4-4 provides a summary description of the seabed along the trunkline route, including seabed features and along the trunkline route from the State waters boundary (KP 32) to the intersection of the trunkline route with the north-western limit of the Montebello Marine Park (approximately KP 191). Beyond KP 191 the seabed is located on the Exmouth Plateau, which is characterised by a thick Triassic sequence overlain by a Jurassic, Cretaceous and Cainozoic sediment sequence; and fine grained carbonate ooze (Fugro, 2010). Sediment samples collected at the end of the trunkline route were predominantly composed of clay and silt; and only small amounts (1–3% w/w) of sand and shell (ERM, 2013).

Table 4-4: Summary of seabed features, sediments, epifauna and infauna along the proposed trunkline route.

Section of Trunkline	Seabed features and sediments	Epifauna and infauna
KP 32 – KP 43.1	• The seabed is predominantly flat, smooth and featureless • Sediments comprise carbonate sands with some finer components.	Sparse ascidians, sponges, invertebrate communities, burrowing organisms and octocorals were observed from the drop camera study. This benthos is considered representative of the area and is similar to that observed in other regional studies (Keesing, 2019; Advisian, 2019a).
KP 43.1 – KP 52.5	• Seabed expected to comprise carbonate sand and shell gravel • The seabed is predominantly flat and featureless between KP 43.1 and KP 52.5 • Minor accumulations of coarser sediments between KP 43.9 and KP 44.9 and KP 47.1 to KP 50 • KP 50 to KP 52 there are a number of isolated depressions visible on the seafloor.	
KP 52.5 – KP 108.4	• Seabed sediments are expected to comprise carbonate sands with shell gravel • Depressions appear throughout the route corridor it seems that the clusters of depressions mostly occur when the calcarenite is outcropping at seafloor. These depressions run perpendicular to the proposed trunkline route • Geotechnical sampling within this section recovered carbonate sands with some silt content.	The predominantly featureless seabed is not expected to support abundant or diverse benthic communities and is considered typical of the North West Shelf. The presence of oil and gas infrastructure may artificially increase habitat complexity in areas of featureless seabed, resulting in higher species richness and abundance of fish species and epifauna associated with infrastructure, compared to adjacent natural habitats (McLean et al., 2020; McLean et al., 2018; McLean et al., 2017; Bond et al., 2018).
KP 108.4 – KP117.6 (Montebello Marine Park MUZ)	• Seabed sediments are expected to comprise carbonate sands with shell gravel which was confirmed by geotechnical sampling • Localised increases in reflectivity tend to be associated with the presence of numerous depressions and exposure of the underlying calcarenite unit • Shallow soils isopach occur along the corridor and tends to show a cover of sand which suggests that these areas are more likely to represent accumulations of coarse material or disturbed seabed rather than outcrop.	The results of previous benthic studies in the Montebello Marine Park are largely in alignment with the geophysical data (i.e. typically low relief sandy seafloor (with various bedforms) with occasional rubbly areas increasing at sites more inshore) and dominant benthic organisms identified (which varied in diversity and density within and between survey areas, but typically included a wide variety of sponges and soft corals including whips and gorgonians, hydroids, seapens and crinoids) (Advisian, 2019a). The harder areas of calcarenite have the potential to support more abundant and diverse benthic communities, however the patchiness of the exposure of the underlying hard substrate is expected to limit the potential to support significant epifaunal habitats.
KP 164.1, - KP 173.6 (Montebello Marine Park MUZ)	• Seabed sediments are expected to comprise carbonate sands with shell gravel • The underlying calcarenite is expected to outcrop at seabed within the majority of this area, however, apart from appearing marginally less smooth and sometimes slightly mottled, the seafloor otherwise appears very uniform without any noticeable increase in reflectivity.	
KP 173.6 – KP 191.6 (Montebello Marine Park MUZ)	• Seabed appears moderately reflective and predominantly featureless. Isolated features and clusters are noted. These depressions often show associated small mounds • Between KP 173.4 and KP 178.1 the seafloor appears more irregular and slightly mottled. Lineations in the calcarenite are oriented approximately north-east to south-west, and this	

Section of Trunkline	Seabed features and sediments	Epifauna and infauna
	area is thought to represent the outer reef which is characterised by linear ridges and relict sandwaves • Relict sandwaves are present between KP 184.7 to KP 190.6. The sandwaves exhibit an approximate north-south orientation, have wavelengths of between 150 m to 300 m, and measure up to 10 m in height. Surficial seabed sediments are expected to comprise carbonate sands with shell gravel.	

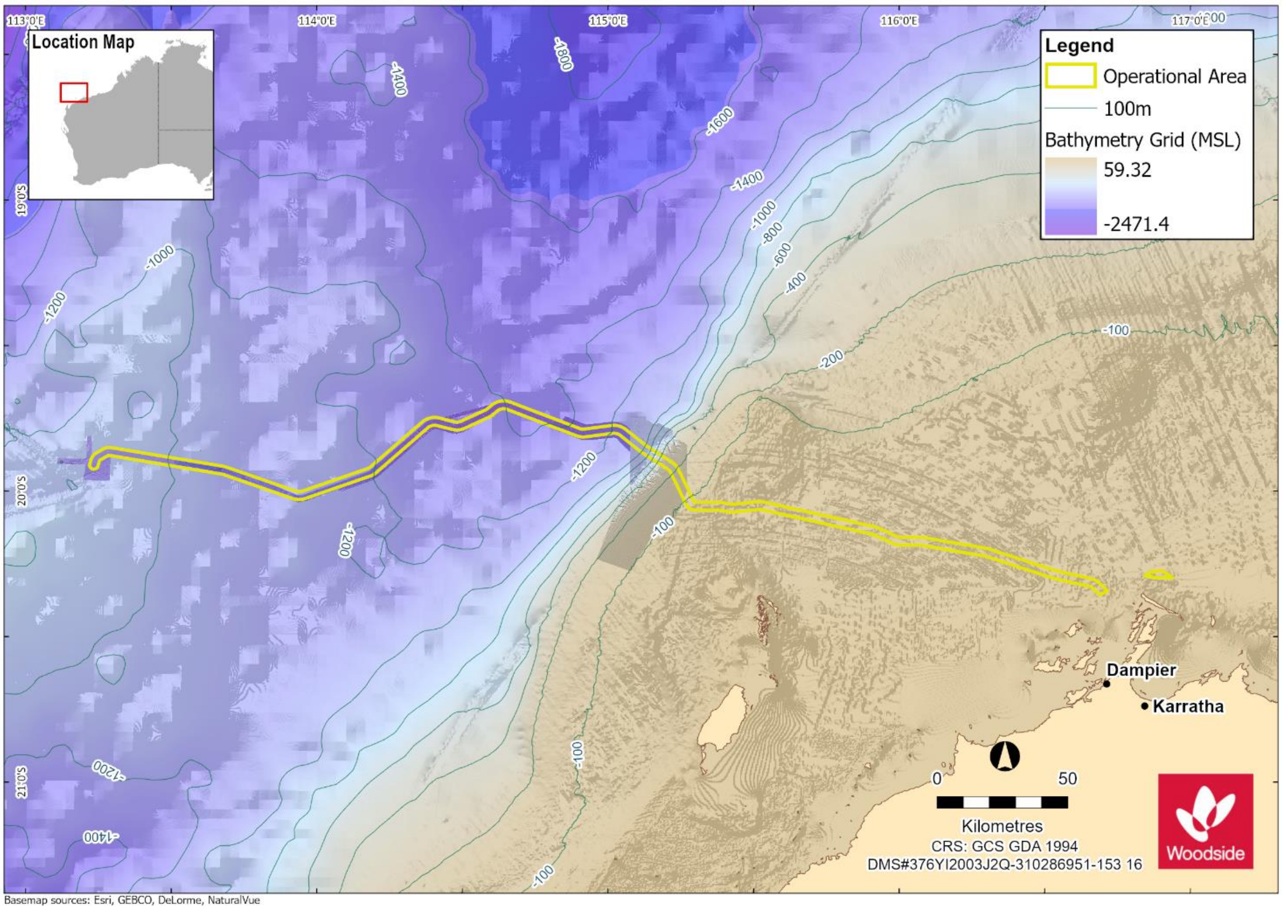


Figure 4-4: Bathymetry of the Operational Area

4.4.3.2 Offshore Borrow Ground Project Area

The Offshore Borrow Ground Project Area lies just outside the State waters boundary to the north-east of the Dampier Archipelago (about 15 km). Water depths in this area are shallow (~35-45 m), increasing gradually in a north to north-west direction. The Offshore Borrow Ground Project Area lies within the continental shelf and is characterised by a generally flat / undulating and uniform seabed.

Surveys have been completed at the Offshore Borrow Ground Project Area (Advisian, 2019b) to determine the suitability of the proposed area as a source of trunkline stabilisation material. Towed video and drop camera surveys of both the potential borrow ground and the Dampier Marine Park directly adjacent to the borrow ground, confirm that the seabed and its benthic composition are relatively uniform in structure and composition. Both locations are dominated by bare substrate with large areas of seabed that are apparently largely devoid of any epibenthic species.

Appendix H and the Scarborough OPP provide a summary of the physical characteristics of the environment within the EMBA.

4.5 Habitats and Biological Communities

4.5.1 Primary Productivity

Primary productivity in the region is typically low, driven by offshore influences, with periodic upwelling and cyclonic events driving coastal productivity (Brewer et al., 2007). Localised upwelling generally occurs as a result of the changing strength of the ITF, internal tides, cyclones, and their interaction with the complex seafloor topography.

The planktonic communities that drive primary productivity in the region are comprised of phytoplankton and zooplankton (protozoa, copepods, ichthyoplankton etc.). Phytoplankton abundance increases as a result of an increase in nutrient availability, in turn supporting an increase in zooplankton. Mass coral spawning events in the NWMR during March and April contribute to peaks in zooplankton abundance.

The planktonic communities of the EMBA and Operational Area are likely to be representative of the wider region. Offshore planktonic communities feature smaller taxa, whereas inshore communities are dominated by larger taxa such as diatoms. The greatest productivity is likely to be around the 200 m isobath, associated with the shelf break. Further information regarding the planktonic communities of the Scarborough Area and the NWMR are detailed in **Section 4.2 – 4.3** of **Appendix H** and the Scarborough OPP**.**

4.5.2 Benthic Habitats and Communities

The NWMR is characterised by diverse nearshore primary producer habitats such as seagrass meadows, coral reefs and mangrove forests, to offshore soft sediment seabed habitats and submerged and emergent reef systems. Benthic communities range from infauna and low density sessile filter feeders of soft sediments and deeper waters, mobile macrobenthos and diverse hard coral communities in shallower habitats. **Table 4-1** in **Appendix H** provides further details for the habitats and biological communities found within the NWMR.

The EMBA is likely representative of the wider region, featuring sparse mobile epifauna (i.e., arthropods and echinoderms) and sessile filter feeders (sponges, soft corals etc.). Hard coral assemblages are generally found in shallower waters (< 50 m) on the seaward slopes of outer islands of the Dampier Archipelago, as well as fringing reefs around the Montebello Islands, Barrow Island, Muiron Islands and Ningaloo Reef. Regionally significant Rankin Bank and Glomar Shoal (~114 km north-west and ~84 km north of the Trunkline Project Area, respectively), are present within the EMBA, hosting diverse benthic assemblages across complex seafloor features. Glomar Shoal is designated a (Key Ecological Feature (KEF) (**Table 9-1**, **Appendix H**). Seagrass meadows and benthic macroalgae reefs are located in shallow waters surrounding the Dampier Archipelago, Muiron and Barrow islands in sheltered areas and subtidal habitats (**Table 4-1, Appendix H**).

The Trunkline Project Area is likely to feature sparse ascidians, sponges, invertebrates, infauna and burrowing organisms and octocorals, representative of the area (**Table 5-2**, **Appendix H**). No primary producer communities (hard corals, seagrass, macroalgae) are expected to occur due to the lack of light. A rock pinnacle field (in ~300 m water depth) is the only natural substrate not classified as soft sediment, providing habitat for a diverse range of epifaunal and demersal species that commonly occur across the NWMR, including a very low percentage cover of soft coral growing on top of the pinnacles. The pinnacles are isolated forms, ~350 m south of the trunkline at KP 209, and do not constitute a continuous reef. The benthic communities of the Trunkline Project Area are further detailed in **Table 4-5**.

The Offshore Borrow Ground Project Area is likely to feature little to no biota, with anemones and crinoids accounting for less than 5% cover. Where epibenthos is present, the percentage cover of species is comparatively low (in the order of 5%), with no transects recording greater than 10% coverage in the species present. Common species present were alcyonaceans (mainly solitary soft corals), pennatulaceans (sea pens), crinoids (feather stars), asteroids (sea stars) and hydroids. No benthic primary producer habitat in the form of hard corals, macroalgae or seagrass was recorded or observed along any of the survey transects. The benthic habitat observed is consistent with a broad scale characterisation of the Pilbara seabed undertaken by UWA and CSIRO (Pitcher et al., 2016) and unpublished results from a recent survey by CSIRO (Keesing, 2019).

Surveys of Spoil Ground 5A indicated sparse coverage of ascidians, sponges, invertebrate communities, octocorals and infauna, representative of the wider NWMR (Woodside, 2009).

4.5.3 Shoreline and costal habitats

Coastal and shoreline habitats do not occur in the Trunkline Project Area, nor the Offshore Borrow Ground Project Area; however, they occur within the EMBA and are discussed briefly below.

The shoreline of the NWMR features tidal flats, sandy beaches and rocky shores, often exposed to high tidal variation. Coastal habitats that occur on the coastline within the EMBA include saltmarshes and mangroves around the Dampier Archipelago (**Table 4-1**, **Appendix H**).

Key habitats and ecological communities within the EMBA are identified in Table 4-5 and described in **Appendix H** and the Scarborough OPP.

4.5.4 Marine Fauna

The Dampier Archipelago hosts over 650 species of fish, including sawfishes, sharks, rays, as well as a wide range of marine mammals, reptiles and seabirds. The benthic and pelagic fish communities of this region are highly depth dependent, and several fish biodiversity hotspots have been identified. Inner shelf species include lizardfishes, goatfishes, trevally, angelfishes and tuskfishes. Deeper water species include deep goatfishes, threadfin bream and lizardfishes, ponyfishes, billfishes and tuna. The region also supports a number of commercial fish species including snapper, emperor, Rankin cod and bream. Resident marine mammals of the NWMR typically reside in shallower coastal waters, including bottlenose and Indo-Pacific humpback dolphins and dugongs, as well as extensive critical and biologically important habitats for marine turtles. Migratory species through the region are predominately whales and seabirds or shorebirds.

The Operational Area and wider EMBA are typically representative of the wider region. Biodiversity hotspots within the EMBA include Glomar Shoal, the outer islands of the Dampier Archipelago and the sheltered waters of Shark Bay. **Table 4-5** summarises the habitats and biological communities within the EMBA, which are further detailed in Section 4.4 of **Appendix H** and the Scarborough OPP.

Table 4-5: Habitats and communities within the Operational Area, Zone of Influence and EMBA

Habitat/Community	Operational Area	Zone of Influence	EMBA
Habitats			
Coral	✓	✓	✓
Seagrass beds and macroalgae	X	X	✓
Mangroves	X	X	✓
Saltmarsh	X	X	✓
Communities			
Plankton	Representative of the wider NWMR, with increased abundance associated with increased primary production at the 300 m isobath on the shelf edge.		
Marine fauna	Fish biodiversity associated with benthic habitat. Typical of the NWMR, including migratory cetaceans and seabirds, resident populations of marine turtles, seabirds and shorebirds and dolphins.		
Epifauna	Generally sparse communities of soft corals, sponges, ascidians, octocorals and invertebrates. Areas of hard substrate (i.e., rock pinnacles) may feature high biodiversity of sessile epifauna by providing attachment points.	Sparse communities of sponges, anemones, crinoids, soft corals and ascidians. Some incursion into areas of higher biodiversity during winter conditions.	Predominately sparse mobile epifauna (i.e., arthropods and echinoderms) and sessile filter feeders (sponges, soft corals etc.). Increased biodiversity in nearshore fringing reefs, offshore islands and regionally significant shoals includes crustaceans, site-attached fish, sponges, soft corals and other invertebrates.
Infauna	Bioturbating infauna, polychaetes and annelids found in areas of soft sediments.		

4.6 Protected Species

A total of 74 EPBC Act listed species considered to be MNES were identified as potentially occurring within the EMBA, of which 43 species were identified as potentially occurring within the Operational Area. Several species considered to be MNES were not included (e.g., terrestrial species occurring within the EMBA); however, species for which coastal and shoreline environments were a dominant habitat were included. The full list of marine species identified in PMST reports is provided in **Appendix C**.

Two conservation dependent species have also been identified with a potential to occur within the Operational Area; the scalloped hammerhead shark and the southern bluefin tuna. Species identified as potentially occurring within the Operational Area and EMBA and Biologically Important Areas (BIAs) or Habitat Critical to their Survival (Habitat Critical) that overlap the Operational Area and EMBA are listed in **Table 4-6** to **Table 4-15**, and a description of species is included in **Appendix H** and the Scarborough OPP. **Figure 4-5** to show the spatial overlap with relevant BIAs and Habitat Critical areas and the Operational Area and EMBA.

4.6.1 Fish, Sharks and Rays

Table 4-6: 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*
Anoxypristis cuspidata	Narrow Sawfish	N/A	Migratory	✓	✓
Carcharias taurus	Grey nurse shark (West coast population)	Vulnerable		✓	✓
Carcharhinus longimanus	Oceanic whitetip shark	Vulnerable	Migratory	✓	✓
Carcharodon carcharias	White shark	Vulnerable	Migratory	✓	✓
Isurus oxyrinchus	Shortfin mako	N/A	Migratory	✓	✓
Isurus paucus	Longfin mako	N/A	Migratory	✓	✓
Lamna nasus	Mackerel shark	N/A	Migratory		✓
Manta alfredi	Reef manta ray	N/A	Migratory	✓	✓
Manta birostris	Giant manta ray	N/A	Migratory	✓	✓
Pristis clavata	Dwarf sawfish	Vulnerable	Migratory	✓	✓
Pristis zijsron	Green sawfish	Vulnerable	Migratory	✓	✓
Pristis pristis	Freshwater sawfish	Vulnerable	Migratory		✓
Rhincodon typus	Whale shark	Vulnerable	Migratory	✓	✓

Table 4-7: Fish, shark and ray BIAs within the Operational Area and EMBA

Species	BIA type	Approximate distance and direction of BIA from Operational Area (km)
Whale shark	Foraging (northward from Ningaloo along 200 m isobath)	Overlaps Operational Area between about KP 72 and KP 199. Overlaps EMBA to the east
	Foraging (high density prey)	Overlaps EMBA along the Ningaloo coastline.

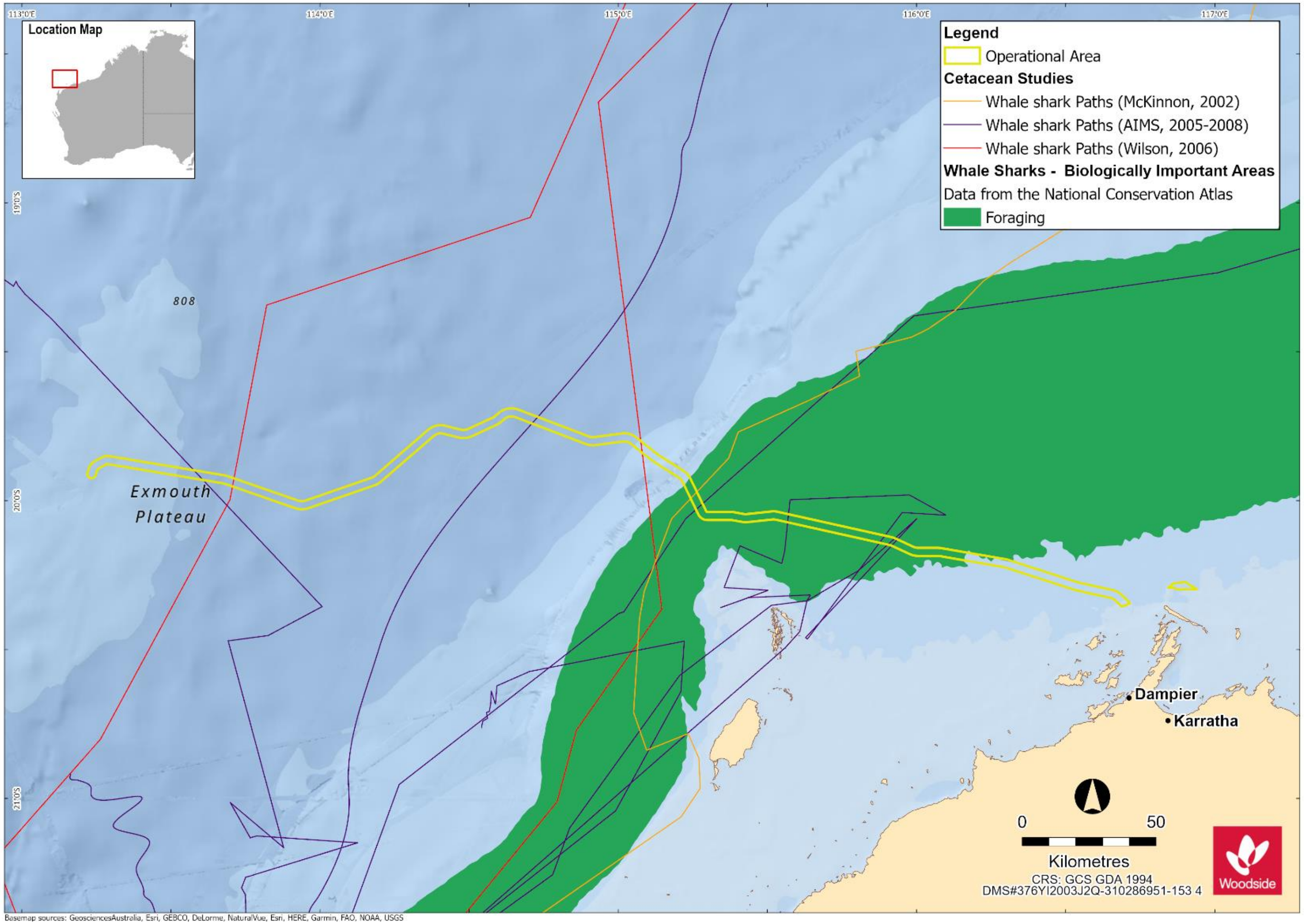


Figure 4-5: Whale shark BIAs overlapping the Operational Area and satellite tracks of whale sharks tagged between 2005 and 2008 (Mckinnon,2002; AIMS, 2005-2008; Wilson, 2006)

4.6.2 Marine Reptiles

Table 4-8: 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*
Aipysurus apraefrontalis	Short-nosed seasnake	Critically Endangered		✓	✓
Aipysurus foliosquama	Leaf-scaled seasnake	Critically Endangered			✓
Caretta caretta	Loggerhead turtle	Endangered	Migratory	✓	✓
Chelonia mydas	Green turtle	Vulnerable	Migratory	✓	✓
Dermochelys coriacea	Leatherback turtle	Endangered	Migratory	✓	✓
Eretmochelys imbricata	Hawksbill turtle	Vulnerable	Migratory	✓	✓
Natator depressus	Flatback turtle	Vulnerable	Migratory	✓	✓

Table 4-9: Marine turtle BIAs within the Operational Area and EMBA

Species	BIA type	Approximate distance and direction of BIA from Operational Area (km)
Flatback turtle	Internesting (Thevenard Island, Montebello Islands, Dampier Archipelago)	Overlaps Operational Area between about KP 32 and KP 199.
	Nesting (Thevenard Island, Barrow Island, Montebello Islands, Legendre Island, Huay Island)	Overlaps EMBA in several places. Occurs ~29 km south of KP 145, 9 km south of Offshore Borrow Ground Project Area.
	Mating (Barrow Island, Montebello Islands)	Occurs within EMBA, ~29 km south of KP 145, around Montebello Islands and Barrow Island.
	Foraging (Barrow Island, Legendre Island, Huay Island)	Overlaps with EMBA in several places. Occurs ~65 km south of KP 145, around Barrow Island, 9 km south of Offshore Borrow Ground Project Area.

Species	BIA type	Approximate distance and direction of BIA from Operational Area (km)
Green turtle	Internesting (North West Cape, Muiron Islands, Montebello Islands, Barrow Island)	Overlaps Trunkline Project Area at KP 32 – KP 50, and Offshore Borrow Ground Project Area. Also occurs within the EMBA around the Montebello Islands (~5 km south of KP 149), Barrow Island (~44 km south of KP 149) and around offshore fringing islands from Dampier Archipelago to Cape Range.
	Nesting (North West Cape)	Overlaps EMBA around the offshore fringing islands from Dampier Archipelago to Cape Range, ~10 km east of KP 32 at closest point and around Montebello Islands and Barrow Island (~25 km south of KP 149).
	Foraging (North West Cape, Dixon Island, Montebello Islands, Barrow Island)	Overlaps EMBA around the offshore fringing islands from Dampier Archipelago to Cape Range, ~10 km east of KP 32 at closest point and around Montebello Islands and Barrow Island (~25 km south of KP 149). Foraging BIA ~182 km north-east is highlighted as unique to WA.
	Mating (Dampier Archipelago, Montebello Islands, Barrow Island)	Overlaps EMBA around the offshore fringing islands from Dampier Archipelago, ~10 km east of KP 32 at closest point and around Montebello Islands and Barrow Island (~25 km south of KP 149).
	Basking (Barrow Island)	Overlaps EMBA on the west coast of Barrow Island (~44 km south of KP 149).
	Aggregation (Middle and North Mangrove Island, Montebello Islands)	Overlaps EMBA, closest point is ~41 km south of KP 160.
Hawksbill turtle	Internesting (Ningaloo coast and Jurabi coast1, Thevenard Island, Barrow Island, Lowendal Islands, Montebello Islands, Varanus Island)	Overlaps Trunkline Project Area from KP 32 to ~KP 53 and Offshore Borrow Ground Project Area. Overlaps EMBA at Montebello Islands and Barrow Island ~10 km south of KP 160, Thevenard Island (~131 km south of KP 180), and Cape Range (~202 km south of KP 180).
	Nesting (Ningaloo coast and Jurabi coast, Thevenard Island, Barrow Island, Varanus Island, Lowendal Islands, Dixon Island)	Overlaps EMBA around the offshore fringing islands from Dampier Archipelago, ~10 km east of KP 32 to Cape Range, Montebello Islands (~30 km south of KP 160), Barrow Island (~64 km south of KP 160).
	Foraging (De Grey River to Bedout Island, Burrup Peninsula, Cape Preston to Onslow, Dixon Island)	Overlaps EMBA at Burrup Peninsula (~10 km east of KP 32) to Onslow, Montebello Islands and Barrow Island (~30 km south of KP 160 at closest point), De Grey River to Bedout Island BIA, ~185 km north-east of Offshore Borrow Ground Project Area, is key foraging ground for all 4 species.
	Mating (Burrup Peninsular, Montebello Islands, Barrow Island)	Overlaps EMBA at Burrup Peninsula (~10 km east of KP 32), Montebello Islands and Barrow Island (~30 km south of KP 160 at closest point).

Species	BIA type	Approximate distance and direction of BIA from Operational Area (km)
	Migration corridor (Burrup Peninsular)	Overlaps EMBA around Burrup Peninsula (~10 km east of KP 32).
Loggerhead turtle	Internesting (Ningaloo coast and Jurabi coast, Muiron Islands, Gnaraloo Bay, Montebello Islands, Lowendal Island, Dirk Hartog Island)	Overlaps Operational Area at KP 32 – KP 52. Overlaps the EMBA at ~19 km south of KP 160, surrounding the Montebello Islands and ~186 km south of KP 160 on the Ningaloo coast.
	Nesting (Ningaloo coast and Jurabi coast, Muiron Islands, Gnaraloo Bay, Montebello Islands, Lowendal Island, Dirk Hartog Island, Cohen Island)	Overlaps the EMBA ~237 km south of KP 160 on the Ningaloo coast. Cohen Island BIA is ~10 km from KP 32.
	Foraging (De Grey River to Bedout Island)	De Grey River to Bedout Island BIA, ~185 km north-east of Offshore Borrow Ground Project Area, is key foraging ground for all 4 species.

Table 4-10: 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 and direction from Operational Area (km)	Inter-nesting buffer	Nesting period	Hatching period
Green turtle	North West Shelf	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	Overlaps Operational Area	20 km	Nov–Mar (peak: Dec-Feb)	Jan–May (peak: Feb–Mar)
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 Operational Area	60 km	Oct–Mar (peak: Nov-Jan)	Feb–Mar
Hawksbill turtle	Western Australia	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	Overlaps Operational Area	20 km	All year (peak: Oct–Feb)	All year (peak: Dec–Feb)
Loggerhead turtle	Western Australia	Exmouth Gulf and Ningaloo coast, Gnaraloo Bay and beaches	~200 km south-east of KP 180	20 km	Nov–Mar (peak: Jan)	Jan-May

Species	Genetic Stock	Nesting Locations	Approximate distance and direction from Operational Area (km)	Inter-nesting buffer	Nesting period	Hatching period
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					

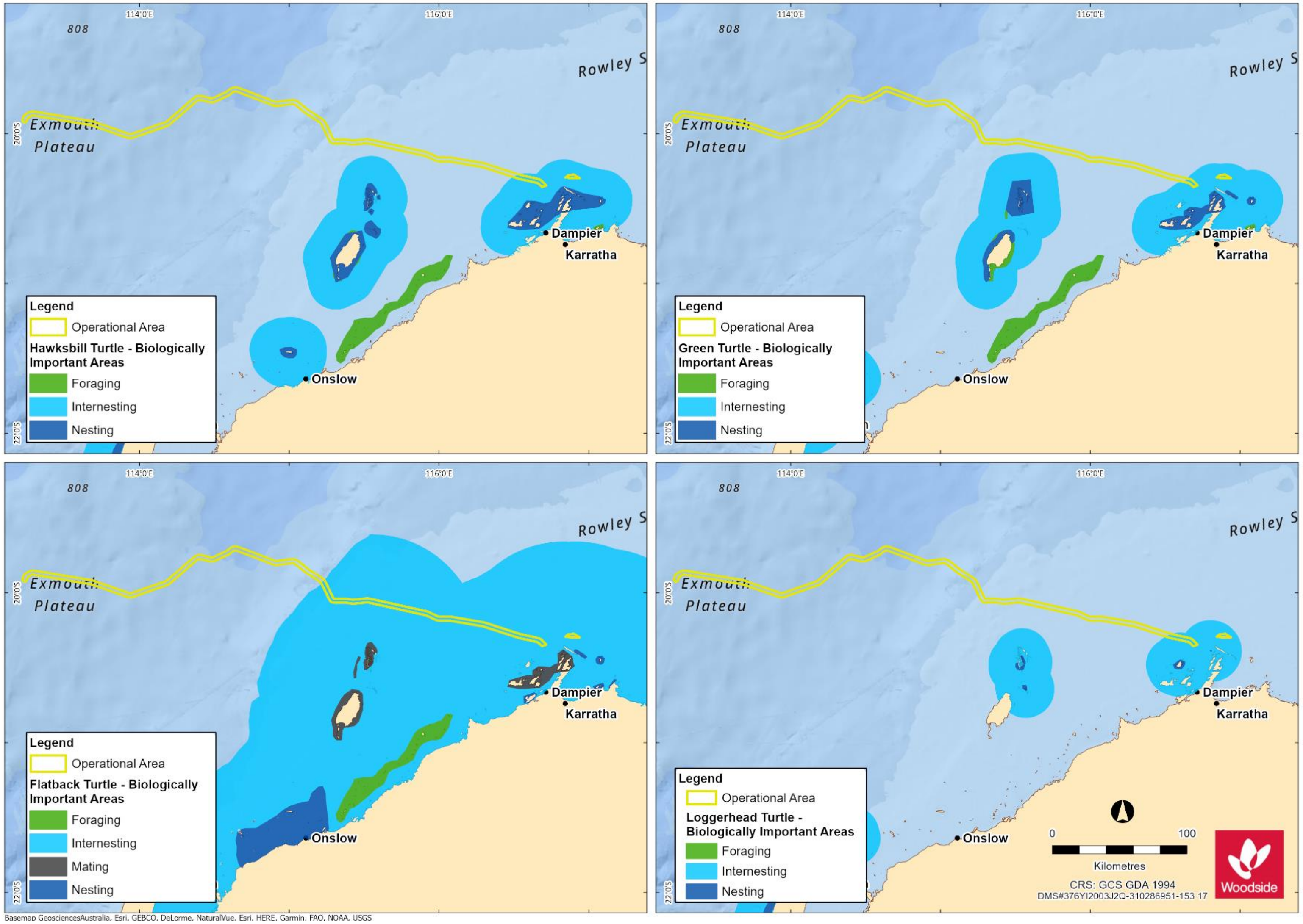


Figure 4-6: Marine reptile BIAs overlapping the Operational Area

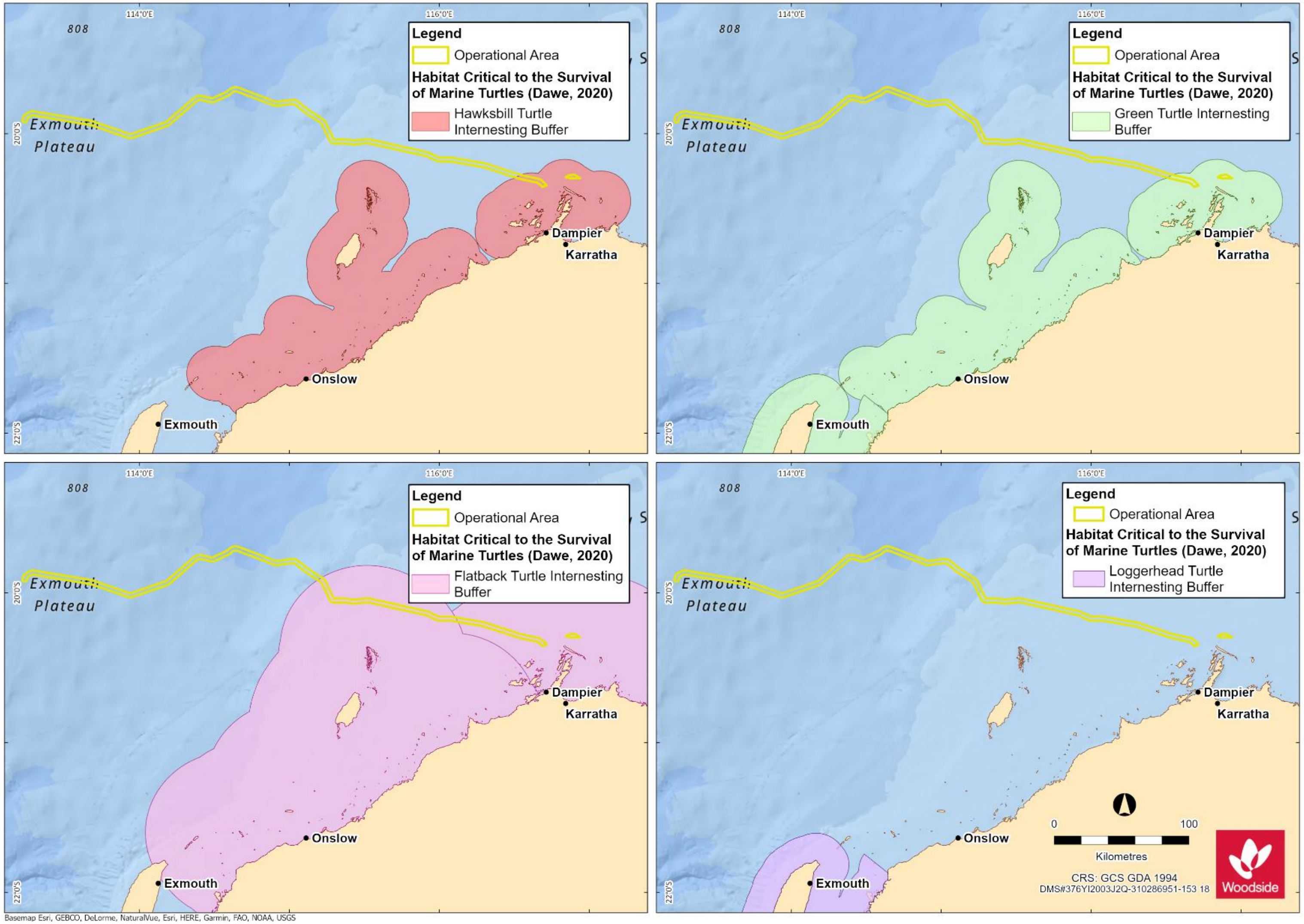


Figure 4-7: Habitat Critical to the survival of marine turtles overlapping the Operational Area

The closest known turtle nesting beaches to the Trunkline and Borrow Ground Project Areas are the islands of the Dampier Archipelago. Beaches of the Dampier Archipelago, where marine turtle nesting are summarised in **Table 4-12**. Rosemary Island has the most significant nesting beaches, determined as mean number of hawksbill, green and flatback turtle tracks per day (Pendoley et al., 2016) and is recognised as an internationally significant rookery for hawksbill turtles, with one of the largest nesting populations in Australia and globally (Limpus, 2009). On Rosemary Island, the majority of hawksbill nesting occurs on the north-western beaches (K. Pendoley, pers. comm.) with lower density flatback and green nesting occurring at beaches on the eastern end of the Island. Seasonality of nesting differs between flatback, green and hawksbill turtles; **Table 4-16** provides a summary of the key seasonal sensitivities for protected marine reptile species identified as occurring within the Operational Area. A study by Whiting (2018) provides defined seasonality specific nesting data for Rosemary Island, and found that hawksbill turtles have a much earlier peak (October/November) compared to flatback turtles (December/January). Seasonality for green turtles was not well defined from the available data (Whiting, 2018). Given the discrete duration of surveys at Legendre Island (Biota, 2009), insufficient data is available to refine seasonality for this location.

CALM (1990) reports loggerhead turtle nesting activity on Cohen Island however, Pendoley et al. (2016) did not find evidence of loggerhead nesting activity over 20 years of track data. The northernmost key loggerhead nesting areas include the North West Cape and Muiron Islands. Any nesting activity by loggerhead turtles in the Dampier Archipelago will not represent significant rookeries for this species (PENV, 2020a). No major leatherback turtle rookeries are known to occur in Australia, with scattered nesting reported in Queensland (Limpus and MacLachlan, 1979, 1994; Limpus et al., 1984) and the Northern Territory (Hamann et al., 2006; Limpus and MacLachlan, 1994) only.

Table 4-11: Records of nesting behaviour of green, flatback and hawksbill turtles on islands of the Dampier Archipelago (CALM, 1990; Pendoley et al., 2016; Biota, 2009)

	Angel	Burrup Peninsula	Conzinc	Delambre	Dolphin	Eaglehawk	East Goodwyn	East Intercourse	Elphick Nob	Enderby	Hauy	Intercourse	Keast	Lady Nora	Legendre	Rosemary	West Intercourse	West Mid Intercourse
Trunkline Project Area distance (km)	17	22	22	38	17	41	25	32	14	27	27	34	13	12	12	14	36	35
Borrow ground Project Area distance (km)	21	26	28	20	16	57	41	42	32	43	14	45	10	28	6.6	40	48	46
Flatback	X	X	X	M	X	L	X	X	X	M	X	X	X	X	L	M	X	X
Green	-	X	-	L	X	L	-	X	-	L	X	-	-	-	X	M	X	-
Hawksbill	L	-	-	L	-	L	X	-	X	M	-	-	-	-	X	H	-	-

Key	
	Island is within 20 km of the Project Areas plus nesting at 'Low' or above
	Island is within 20 km of the Project Areas, but nesting is less than 'Low'
	Island is more than 20 km from Project Areas
-	Absent
X	Present
L	Low: 1 – 10 tracks per day
M	Moderate: 11 – 100 tracks per day
H	High: 101 – 500 tracks per day

4.6.3 Marine Mammals

Table 4-12: 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 bonaerensis	Antarctic minke whale	N/A	Migratory	✓	✓
Balaenoptera borealis	Sei whale	Vulnerable	Migratory	✓	✓
Balaenoptera edeni	Bryde's whale	N/A	Migratory	✓	✓
Balaenoptera musculus	Blue whale	Endangered	Migratory	✓	✓
Balaenoptera physalus	Fin whale	Vulnerable	Migratory	✓	✓
Eubalaena australis	Southern right whale	Endangered	Migratory		✓
Dugong dugon	Dugong	N/A	Migratory	✓	✓
Megaptera novaeangliae	Humpback whale	Vulnerable	Migratory	✓	✓
Orcinus orca	Killer whale	N/A	Migratory	✓	✓
Physeter macrocephalus	Sperm whale	N/A	Migratory	✓	✓
Sousa chinensis	Indo-Pacific humpback dolphin	N/A	Migratory	✓	✓
Tursiops aduncus	Spotted bottlenose dolphin (Arafura/Timor Sea populations)	N/A	Migratory	✓	✓

Table 4-13: Marine mammal BIAs within the Operational Area and EMBA

Species	BIA type	Approximate distance and direction from Operational Area (km)
Dugong	Breeding, nursing, calving (Exmouth Gulf and Ningaloo Reef year round).	Overlaps EMBA
	Foraging high density seagrass beds (Exmouth Gulf and Ningaloo Reef year round)	
Pygmy blue whale	Migration (Augusta to Derby, tend to pass along the shelf edge at depths of 500 m to 1000 m; appear close to coast in the Exmouth-Montebello Islands area on southern migration) (Migration timing is provided in **Table 4-16**)	Overlaps Trunkline Project Area between ~KP 200 and ~KP 374. Overlaps EMBA in north-east to south-west direction
	Distribution	Overlaps EMBA
	Foraging (Ningaloo coast)	Overlaps EMBA
Humpback whale	Migration	Overlaps Trunkline Project Area between ~KP 32 and ~KP 145. Extends through EMBA in north-east to south-west direction out to ~100 km offshore. From North West Cape to south of Shark Bay the migration corridor is reduced to ~ 50 km in width
	Resting (Exmouth Gulf for migration north and south)	Overlaps EMBA

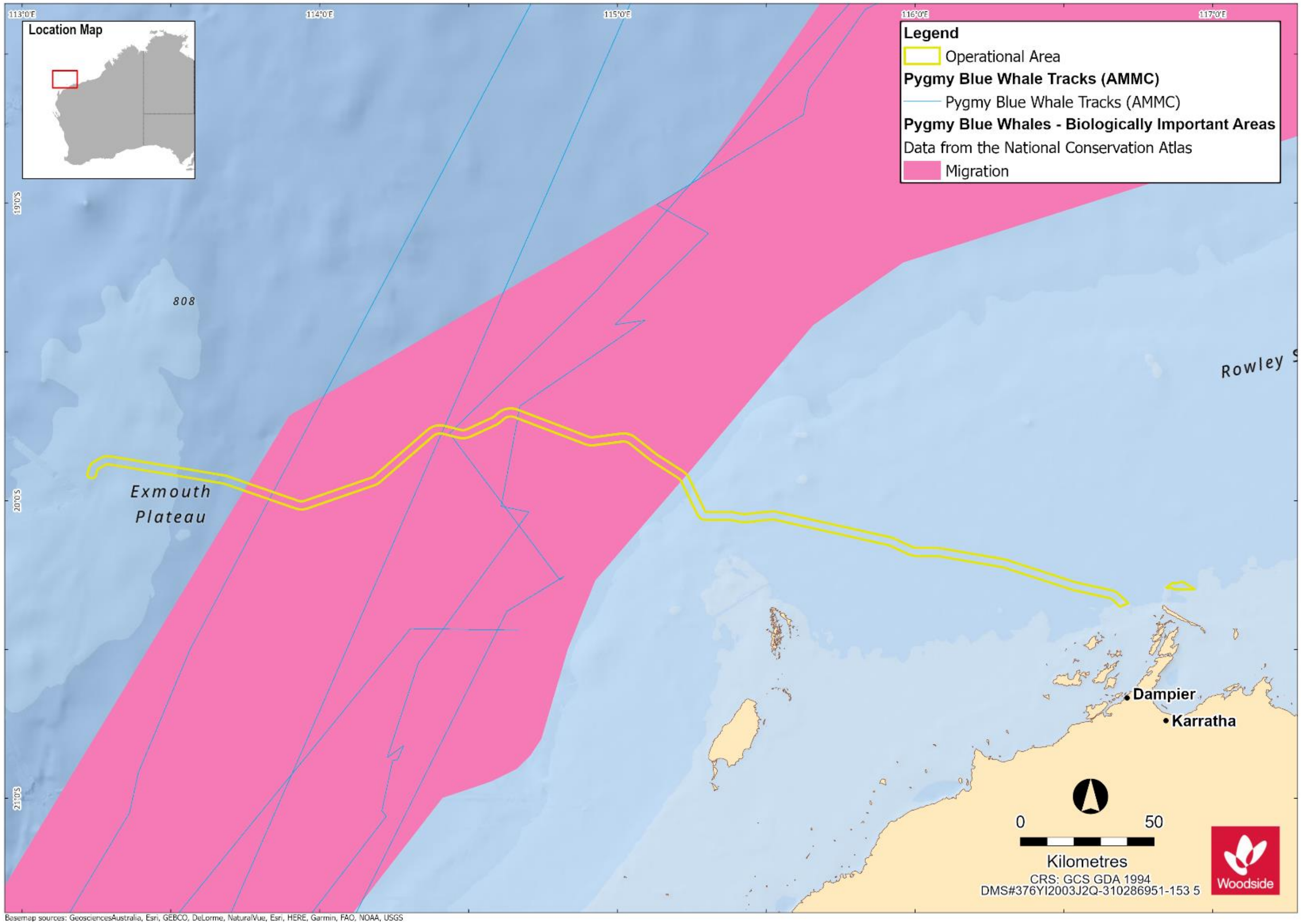


Figure 4-8: Pygmy blue whale BIAs overlapping the Operational Area and satellite tracks of whales tagged between 2009 and 2011 (Double et al., 2012a, 2014)

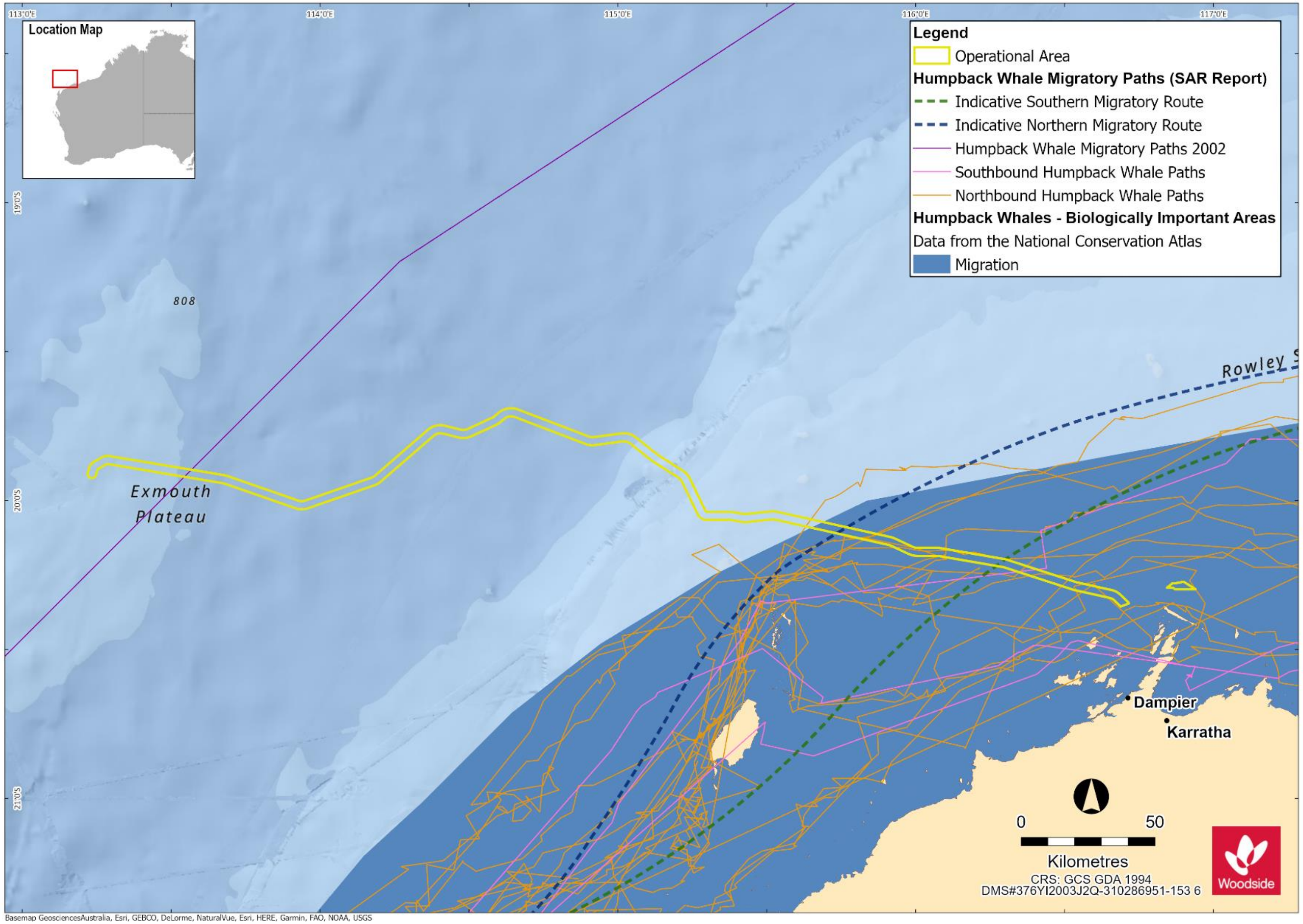


Figure 4-9: Humpback whale BIAs overlapping the Operational Area and satellite tracks of whales tagged between 2010 and 2012 (Double et al., 2012b, 2010)

4.6.4 Seabirds and Migratory Shorebirds

Table 4-14: 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***
Actitis hypoleucos	Common sandpiper	N/A	Migratory	✓	✓
Anous stolidus	Common noddy	N/A	Migratory	✓	✓
Anous tenuirostris melanops	Australian lesser noddy	Vulnerable			✓
Apus pacificus	Fork-tailed swift	N/A	Migratory	✓	✓
Ardenna carneipes	Flesh-footed shearwater	N/A	Migratory		✓
Ardenna pacifica	Wedge-tailed shearwater	N/A	Migratory		✓
Calidris acuminata	Sharp-tailed sandpiper	N/A	Migratory	✓	✓
Calidris canutus	Red knot	Endangered	Migratory	✓	✓
Calidris ferruginea	Curlew sandpiper	Critically Endangered	Migratory	✓	✓
Calidris melanotos	Pectoral sandpiper	N/A	Migratory	✓	✓
Calonectris leucomelas	Streaked shearwater	N/A	Migratory	✓	✓
Charadrius leschenaultia	Greater sand plover	Vulnerable			✓
Charadrius veredus	Oriental plover	N/A	Migratory		✓
Diomedea amsterdamensis	Amsterdam albatross	Endangered	Migratory		✓
Diomedea exulans	Wandering albatross	Vulnerable	Migratory		✓
Falco hypoleucos	Grey falcon	Vulnerable			✓
Fregata ariel	Lesser frigatebird	N/A	Migratory	✓	✓
Fregata minor	Great frigatebird	N/A	Migratory		✓
Glareola maldivarum	Oriental pratincole	N/A	Migratory		✓
Hydroprogne caspia	Caspian tern	N/A	Migratory		✓

Species name	Common name	Threatened status	Migratory status	Potential for interaction	
				Operational Area	*EMBA*
Limnodromus semipalmatus	Asian dowitcher	N/A	Migratory		✓
Limosa lapponica	Bar-tailed godwit	N/A	Migratory		✓
Limosa lapponica menzbieri	Northern Siberian bar-tailed godwit	Critically endangered			✓
Macronectes giganteus	Southern giant petrel	Endangered	Migratory	✓	✓
Macronectes halli	Northern giant petrel	Vulnerable	Migratory		✓
Numenius madagascariensis	Eastern curlew	Critically Endangered	Migratory	✓	✓
Onychoprion anaethetus	Brindled tern	N/A	Migratory		✓
Pandion haliaetus	Osprey	Critically Endangered	Migratory	✓	✓
Papasula abbotti	Abbott's booby	Endangered			✓
Pterodroma mollis	Soft-plumaged petrel	Vulnerable			✓
Rostratula australis	Australian painted snipe	Endangered			✓
Sterna dougallii	Roseate tern	N/A	Migratory	✓	✓
Sternula nereis nereis	Australian fairy tern	Vulnerable		✓	✓
Sula dactylatra	Masked booby	N/A	Migratory		✓
Sula leucogaster	Brown booby	N/A	Migratory		✓
Thalassarche carteri	Indian yellow-nosed albatross	Vulnerable	Migratory		✓
Thalassarche cauta	Shy albatross	Endangered	Migratory		✓
Thalassarche impavida	Campbell albatross	Vulnerable	Migratory		✓
Thalassarche melanophris	Black-browed albatross	Vulnerable	Migratory		✓
Thalassarche steadi	White-capped albatross	Vulnerable	Migratory		✓
Thalasseus bergii	Greater crested tern	N/A	Migratory		✓
Tringa nebularia	Common greenshank	N/A	Migratory		✓

Table 4-15: Seabird and shorebird BIAs within the Operational Area and EMBA

Species	BIA type	Approximate distance and direction from Operational Area (km)
Roseate tern	Breeding (Kimberley, Pilbara and Gascoyne coasts and islands including Ashmore Reef)	Overlaps Operational Area from KP 32 to ~KP 58. Breeding populations occur throughout the EMBA on fringing islands of the Burrup Peninsula, Montebello Islands, North Turtle Island, Airlie Island, the Ningaloo coast and Bernier Island.
Wedge-tailed shearwater	Breeding (Kimberley, Pilbara and Gascoyne coasts and islands including Ashmore Reef)	Overlaps Trunkline Project Area from KP 32 to ~KP 220, and Offshore Borrow Ground Project Area. Occurs throughout EMBA across fringing islands of Dampier Archipelago to Cape Range and to Barrow Island.
Lesser crested tern	Breeding (Kimberley, Pilbara and Gascoyne coasts and islands including Ashmore Reef)	Breeding populations occur in the EMBA around North Turtle Island, Lowendal Islands, and Thevenard Island.
Lesser frigatebird	Breeding (Kimberley, Pilbara and Gascoyne coasts and islands including Ashmore Reef)	Breeding population occurs in the EMBA in up to a 30 km radius from North Turtle Island
Australian fairy tern	Breeding (Pilbara and Gascoyne coasts and islands) with 5 km foraging buffer	Overlaps the Trunkline Project Area from KP 32 to ~KP 34 and directly adjacent to Offshore Borrow Ground Project Area to the south. Breeding populations occur within the EMBA around fringing islands of Burrup Peninsula, Cape Preston, Thevenard Island, Montebello Islands, Lowendal Islands and Barrow Island and Bernier and Dorre islands.
Brown booby	Breeding (Kimberley and northern Pilbara coasts and islands also Ashmore Reef) with 40 km foraging buffer	Occurs in the EMBA at North Turtle Island, 190 km north-east of Operational Area.

4.6.5 Seasonal Sensitivities for Protected Species

Seasonal sensitivities for protected migratory species identified as potentially occurring within the Operational Area are identified in **Table 4-16**. Movement patterns of all protected species identified in **Section 4.5.1** are described in **Appendix H** and the Scarborough OPP.

Table 4-16: 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]												
Marine reptiles												
Green turtle – various nesting/feeding/hatchlings/ mating areas within wider region[3]												
Flatback turtle – various nesting/feeding/hatchlings/ mating areas within wider region[3]												
Hawksbill turtle – various nesting/feeding/hatchlings/ mating areas within wider region[3]												
Loggerhead turtle – various nesting/feeding/hatchlings/ mating areas within wider region[3]												
Marine mammals												
Pygmy blue whale – northern migration (Exmouth, Montebello, Scott Reef)[4]												
Pygmy blue whale – southern migration (Exmouth, Montebello, Scott Reef)[5]												
Humpback whale – northern migration (Jurien Bay to Montebello)[6]												
Humpback whale – southern migration (Jurien Bay to Montebello)[7]												
Seabirds and shorebirds												
Wedge-tailed shearwater – various breeding sites[8]												
Roseate tern – various breeding sites[8]												
Australian fairy tern[8]												

	Species may be present in the Operational Area

Species	January	February	March	April	May	June	July	August	September	October	November	December
	Peak period. Presence of animals is reliable and predictable each year											

References for species seasonal sensitivities:

[1] *DEWHA, 2009*

[2] *TSSC, 2015a; Wilson et al., 2006*

[3] (Chevron Australia Pty Ltd, 2015; CALM, 2005; DSEWPaC, 2012)

[4] *DSEWPaC, 2012; McCauley and Jenner, 2010*

[5] *DSEWPaC, 2012; McCauley and Jenner, 2010*

[6] *CALM, 2005; Jenner et al., 2001; McCauley and Jenner, 2001; Double et al., 2012b*

[7] *McCauley and Jenner, 2001*

[8] *Johnstone and Storr (1998)*

4.7 Key Ecological Features (KEFs)

Key Ecological Features (KEFs) are not MNES, however are considered components of a Commonwealth marine area. They are considered important for a marine regions biodiversity or ecosystem-based functioning. Eight KEFs overlap the EMBA, of which three overlap the Operational Area (**Figure 4-10**), identified in **Table 4-17**, and described in detail in Section 5.5, **Appendix H** and the Scarborough OPP**.**

Table 4-17: KEFs within the Operational Area and EMBA

Key Ecological Feature	Operational Area	EMBA	Description
Exmouth Plateau	Overlaps Operational Area from KP 380 to Offshore Project Area	100% overlap with the EMBA	Water depth: 500 m – 5000 m. Unique seafloor features with regional ecological significance. Believed to affect deep water flow and associated with internal tides, contributing to localised upwelling.
Continental Slope Demersal Fish Communities	Small extent (<0.05%) transects the Trunkline Project Area at ~KP 200	21% overlap with the EMBA	High biodiversity values, hosting more than 500 fish species, 76 of which are endemic.
Ancient Coastline at 125 m depth contour	Overlaps Operational Area around KP 190. Approximately 0.03% of the KEF transects the Trunkline Project Area	30% overlap with the EMBA.	Water depths 115 m – 135 m. Provides hard benthic substrate for regionally significant biodiversity hotspots and localised upwelling. The area where the KEF transects the Trunkline Project Area is predominantly bare sand habitat supporting sparse coverage of benthic organisms.
Canyons linking the Cuvier Abyssal Plain and the Cape Range Peninsula	~166 km south-west of KP 180	100% overlap with the EMBA	Interacts with Leeuwin Current to create localised upwellings and support aggregations of marine megafauna, migratory fish and seabirds.
Commonwealth waters adjacent to Ningaloo Reef	~210 km south-west of KP 180	70% overlap with the EMBA.	Defined as the waters contained within the Ningaloo AMP and thus shares the same ecological values and integrity.
Glomar Shoal	~62 km north of KP 32	100% overlap with the EMBA	Water depths 33 m – 77 m. Defined as a KEF due to high productivity and marine life aggregations.

Key Ecological Feature	Operational Area	EMBA	Description
Western demersal slope and associated fish communities	~875 km south-west of KP 160	1% overlap with the EMBA	Supports high biodiversity of demersal fish communities, with over 480 species described and 31 endemic to the region. Diversity attributed to overlap of ancient and extended Indo-west Pacific and temperate Australasian fauna.
Wallaby Saddle	~723 km south-west of KP 160	22% overlap with the EMBA	Water depths 4000 m – 4700 m. Unique habitat that does not occur at this size in the region. Historically significant sperm whale and baitfish aggregations and relatively enhanced biodiversity.

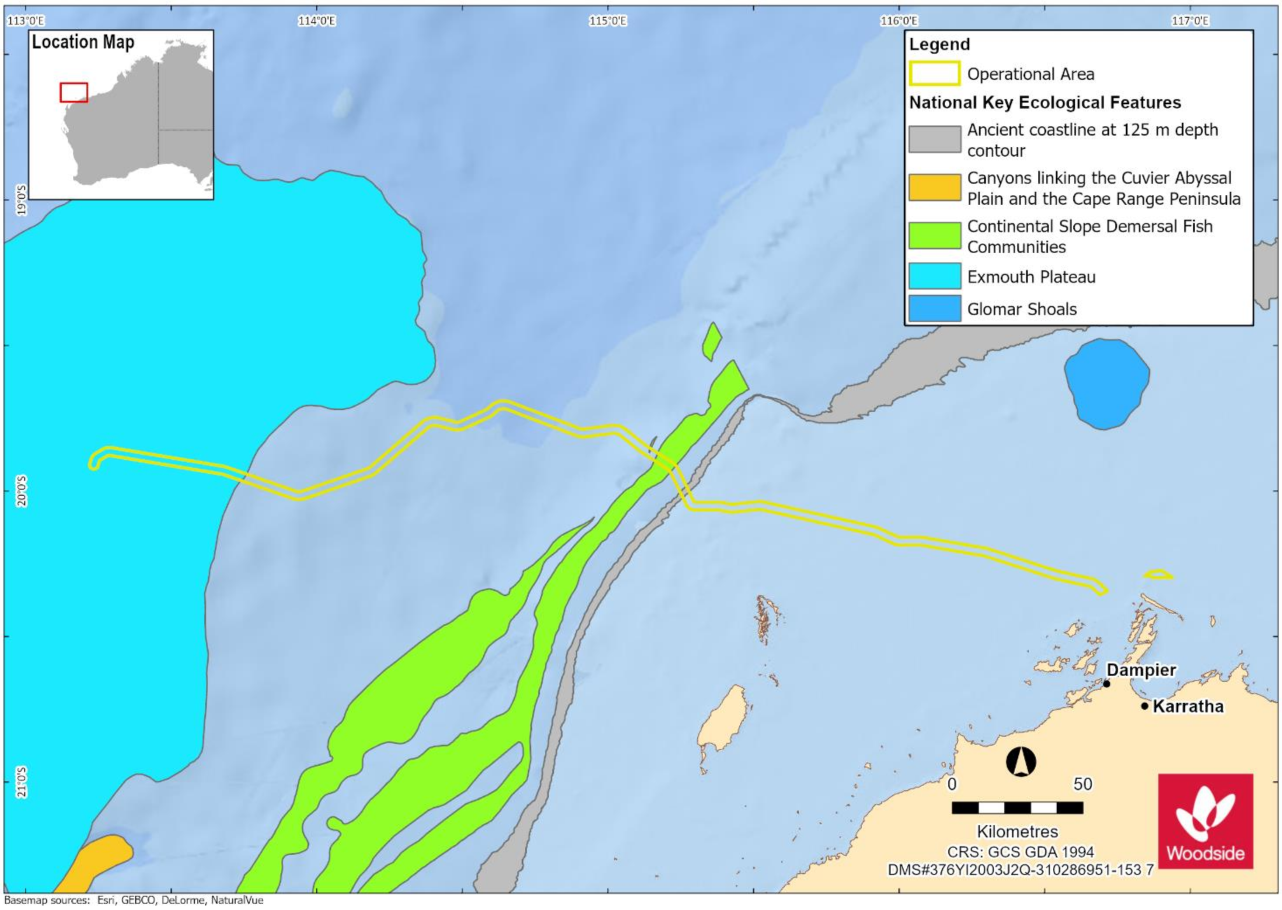


Figure 4-10: KEFs overlapping the Operational Area

4.8 Protected Places

The NWMR offshore environments contains high value or sensitive environmental assets (such as habitat and species) including Commonwealth offshore waters, as well as the wider regional context including coastal waters and habitats.

Many sensitive receptor locations are protected as part of Commonwealth and State managed areas and have been allocated conservation objectives (International Union for Conservation of Nature (IUCN) Protected Area Category) based on the Australian IUCN reserve management principles in Schedule 8 of the EPBC Regulations 2000.

Protected places within the Operational Area and EMBA are identified in Table 4-18 and presented in Figure 4-10. **Appendix H** and the Scarborough OPP outlines the values and sensitivities of protected places and other sensitive areas in the Operational Area and EMBA.

Table 4-18: Established protected places and other sensitive areas overlapping the Operational Area and EMBA

	Distance (km) and direction from Operational Area to protected place or sensitive area	IUCN category* or relevant park zone overlapping the Operational Area and/or EMBA
Australian Marine Parks (AMPs) overlapping EMBA		
Montebello	Overlaps Operational Area between KP 108.4 – KP 191.6	Multiple Use Zone (IUCN VI)
Dampier	<1 km (Offshore Borrow Ground Project Area)	II, IV & VI
Gascoyne	~77 km south of KP 350	II, IV & VI
Ningaloo	~182 km south of KP 350	II & IV
Carnarvon Canyon	~450 km south of KP 350	IV
Abrolhos	~598 km south-west of KP 350	IV
Eighty Mile Beach	~218 km north-east of Offshore Borrow Ground Project Area	VI
Argo-Rowley Terrace	~268 km north-east of KP 200	VI
Shark Bay	~520 km south-west of KP 160	Multiple Use Zone (IUCN VI)
State Marine Parks and Nature Reserves		
Marine Parks		
Montebello	~25 south of KP 160	IA, II, IV & VI
Barrow Island	~45 km south-east of KP 180	IA, VI
Ningaloo	~287 km south-east of KP 350	IA, II & IV
Thevenard Island Nature Reserve	~162 km south-west of KP 160	IA
Great Sandy Island Nature Reserve	~61 km south-west of KP 32	IA
Marine Management Areas		
Barrow Island	~41 km south of KP 160	VI
Muiron Islands	~212 km south-west of KP 160	IA & VI
World Heritage Areas (WHA)		
Ningaloo Coast	~206 km south-west of KP 160	Unassigned
Shark Bay	~562 km south-west of KP 160	IA, II & IV
National Heritage Places (NHP)		
Ningaloo Coast (natural)	~206 km south-west of KP 160	-
Dampier Archipelago (indigenous)	~8 km east of KP 32	-
Shark Bay (natural)	~562 km south-west of KP 160	-
Dirk Hartog Landing – Cape Inscription (historic)	~654 km south-west of KP 160	-
Commonwealth Heritage Properties (CHP)		
Ningaloo Marine Area (natural)	~222 km south-west of KP 160	-

	Distance (km) and direction from Operational Area to protected place or sensitive area	IUCN category* or relevant park zone overlapping the Operational Area and/or EMBA
Ramsar Wetlands of Importance		
None		
Nationally Important Wetlands		
Exmouth Gulf East	~209 km south of KP 160	
Hamelin Pool	~670 km south of KP 160	
Shark Bay East	~576 km south of KP 160	

**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.

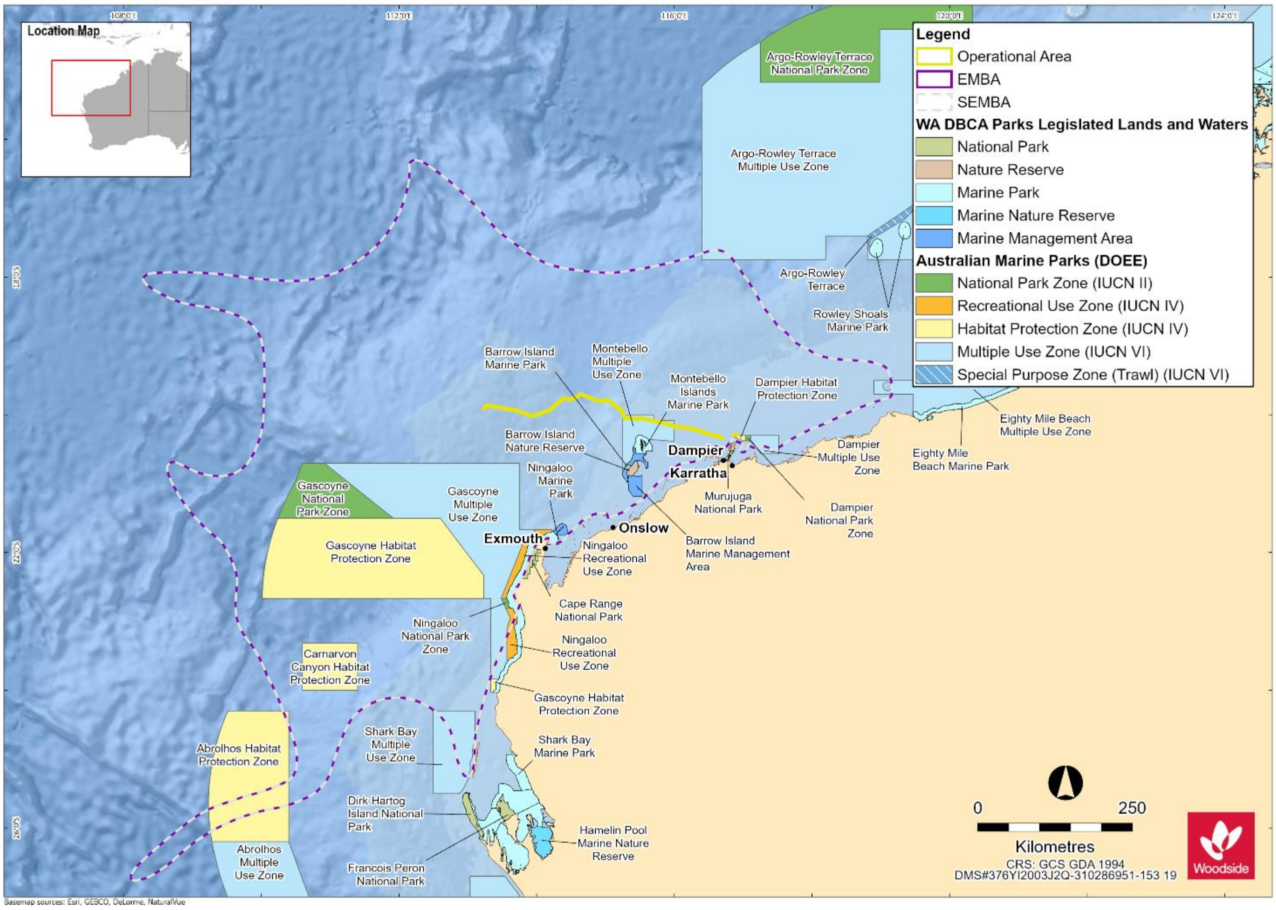


Figure 4-11: Protected areas overlapping the Operational Area and EMBA

4.9 Socio-economic Environment

4.9.1 Cultural Heritage

4.9.1.1 European Sites of Significance

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

4.9.1.2 Indigenous Sites of Significance

Indigenous Australian people have a strong continuing connection with land and sea country that extends back in Indigenous cosmology to the beginning of time and has been confirmed archaeologically to date back at least 65,000 years. Woodside acknowledges this unique connection between Aboriginal peoples and the land and sea in which the company operates, and the continuation of the world's oldest living culture. Woodside also understands that while marine resources used by Indigenous people are 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, particularly through intangible heritage values or culturally significant migratory fauna.

Since the first occupation of Australia by Indigenous peoples, sea levels have changed dramatically. 20,000 years ago, the coastline was more than 100 km offshore from its current location and much of the Operational Area and EMBA would have been located on dry land that would have been available for use by Indigenous people. Traditional knowledge retains a memory of the subsequent sea level rise in some places, and recent archaeological discoveries offer support for claims that the now submerged landscape was occupied and inhabited; Australia's first sub-tidal Indigenous archaeological finds were identified at two locations in the waters of the Burrup Peninsula, approximately 5 km east of the Scarborough Project (Benjamin et al., 2020). There is therefore a possibility of additional archaeological material being located in these areas.

Woodside engaged submerged heritage experts involved in the discovery of the near-shore archaeological finds to assess the prospectivity for archaeological sites along the Scarborough pipeline route and its development envelope beginning at the Burrup Peninsula and ending at the edge of the continental shelf (UWA, 2021). The study, undertaken in consultation with the Murujuga Aboriginal Corporation, concluded that the Scarborough pipeline route is likely to have "low to nil impacts" to Indigenous archaeological values across the project footprint in Commonwealth waters (UWA,2021). The middle shelf landscape crossed by the proposed pipeline was also determined to be of low or no likelihood to yield UCH material (UWA, 2021). Although the outer shelf possesses a highly prospective cultural landscape, the pipeline route itself does not cross any culturally significant landforms or features (UWA,2021).

The existence of any unknown Aboriginal sites or artefacts of significance within the offshore waters of WA is considered highly unlikely (**Appendix G**). Within the wider EMBA, the North West Cape, Barrow Island, Montebello Islands, Burrup Peninsula and the adjacent foreshores have 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.

Woodside has also commissioned ethnographic surveys to identify impacts of the proposal to intangible heritage values and ethnographic sites. Indigenous heritage places including archaeological sites may be protected under the *Aboriginal and Torres Strait Islander Heritage Protection Act 1984*, *Underwater Cultural Heritage Act 2018*, *Aboriginal Heritage Act 1972* (WA) or EPBC Act. The archaeological and ethnographic work conducted by Woodside has not identified any heritage sites which are likely to be protected by these Acts.

The Department of Aboriginal Affairs (DAA) Heritage Inquiry System was searched for the EMBA, which indicated 54 registered Indigenous heritage places (**Appendix G**). The exact location, access and traditional practices for a number of these sites are not disclosed and if required, such as in the event of a major oil spill, would involve prioritising further consultation with key contacts within DAA and relevant local Aboriginal communities.

4.9.1.3 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, nor within 10 km of the Operational Area. The Montebello Marine Park contains two known shipwrecks listed under the Underwater Cultural Heritage Act 2018: Trial (wrecked in 1622), the earliest known shipwreck in Australian waters and Tanami (unknown date) (Director of National Parks, 2018).

4.9.1.4 World, National and Commonwealth Heritage Listed Places

No listed world, national or Commonwealth heritage listed places overlap the Operational Area, however several occur within the EMBA (**Table 4-18**) including:

- Ningaloo Coast (WHA)
- Shark Bay (WHA)
- Ningaloo coast (natural) (NHP)
- Dampier Archipelago (Indigenous) (NHP)
- Shark Bay (natural) (NHP)
- Ningaloo Marine Area – Commonwealth waters (CHP)
- Learmonth Air Weapons Range Facility (CHP).

Table 10-1 of **Appendix H** and the Scarborough OPP outline the values and sensitivities of these places.

The Murujuga Cultural Landscape was also added to Australia's World Heritage Tentative List in 2020, although its boundaries, Outstanding Universal Values and other details necessary to identify the values and sensitivities are yet to be finalised.

4.9.2 Commercial Fisheries

A number of Commonwealth and State fishery management areas are located within the Operational Area and EMBA. FishCube data were 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 4-19** provides an assessment of the potential interaction and **Appendix H** and the Scarborough OPP provide further detail on the fisheries that have been identified through desk-based assessment and consultation (**Section 5**). **Figure 4-12, Figure 4-13**, and **Figure 4-14** shows fisheries identified as having a potential interaction with the Petroleum Activities Program.

Table 4-19: Commonwealth and State commercial fisheries overlapping the Operational Area and EMBA

Fishery	Overlap with Operational Area	Overlap with EMBA	Potential for interaction during activity	
Commonwealth Managed Fisheries				
North West Slope Trawl Fishery	✓	✓	✓	The Operational Area overlaps with the fishery management area for the North West Slope Trawl Fishery. Fishing effort has occurred within the Operational Area and north-east of the Operational Area since at least 2014 (Patterson et al., 2016, 2017, 2018, 2019, 2020). Therefore, fishing effort could occur within the Operational Area, offshore from the 200 m isobath.
Western Deepwater Trawl Fishery	✓	✓	×	The Operational Area overlaps with the northern extent of the fishery management area for Western Deepwater Trawl Fishery. However, fishing effort is concentrated south-west of the Operational Area, offshore of North West Cape along Ningaloo Reef, west of Shark Bay, and offshore Perth Metropolitan area. Therefore, Woodside considers there to be no potential for interaction with this fishery.
Southern Bluefin Tuna Fishery	✓	✓	×	While there is an overlap with the fishery management area and the Operational Area, no fishing effort has occurred within or nearby to the Operational Area for at least the last ten years (Patterson et al,. 2020). Accordingly, Woodside considers there to be no potential for interaction with this fishery given the current distribution of fishing effort is focused in the Great Australian Bight, Tasmania and along the New South Wales coast.
Western Skipjack Tuna Fishery	✓	✓	×	The Western Skipjack Tuna Fishery is not currently active and no fishing has occurred since 2009 (Patterson et al., 2020). Therefore, no fishing effort occurs within the Operational Area and Woodside considers there to be no potential for interaction with this fishery.
Western Tuna and Billfish Fishery	✓	✓	×	While there is an overlap with the fishery management area and the Operational Area, no fishing effort has occurred within or nearby to the Operational Area for at least the last ten years (Patterson et al., 2020). Accordingly, Woodside considers there to be no potential for interaction with this fishery given the current distribution of fishing effort is concentrated south-west of the Operational Area from Exmouth to Augusta.
State Managed Fisheries				
West Coast Deep Sea Crustacean Managed Fishery	✓	✓	×	While there is an overlap with the fishery management area for the West Coast Deep Sea Crustacean Managed Fishery and the Operational Area, fishing effort is concentrated south-west the Operational Area from Carnarvon to Fremantle. Therefore, Woodside considers there to be no potential for interaction with this fishery.
Pilbara Trap Managed Fishery	✓	✓	✓	The Operational Area overlaps with the management area for the Pilbara Trap Managed Fishery. The Operational Area is located across six 60 nm CAES blocks (20160, 20150, 20130, 19150, 19140, and 19130). Fishing effort has occurred within the Operational Area in 60 nm CAES blocks 19150, 19160, 20150 and 20160 from 2010 – 2020 (DPIRD, 2021). Fishing effort within 10 nm CAES blocks

Fishery	Overlap with Operational Area	Overlap with EMBA	Potential for interaction during activity	
				is unknown. Therefore, fishing effort could occur within the Operational Area.
Pilbara Trawl (Interim) Managed Fishery	✓	✓	✓	The Operational Area overlaps with the management area for the Pilbara Trawl (Interim) Managed Fishery. Fishing effort has occurred within the Operational Area in 60 nm CAES block 20160 and 10 nm CAES block 200160 from 2010 – 2020 (DPIRD, 2021). Therefore, fishing effort could occur within the Operational Area.
Pilbara Line Fishery	✓	✓	✓	The Operational Area overlaps with the management area for the Pilbara Line Fishery. Fishing effort has occurred within the Operational Area in 60 nm CAES blocks 19140, 19150, 20150 and 20160 from 2010 – 2020 (DPIRD, 2021). Fishing effort within 10 nm CAES blocks is unknown. Therefore, fishing effort could occur within the Operational Area.
Mackerel Managed Fishery (Area 2 and 3)	✓	✓	✓	The Operational Area overlaps with the management area for the Mackerel Managed Fishery (Area 2 and 3). Fishing effort has occurred within the Operational Area in 60 nm CAES blocks 19150, 20150 and 20160 from 2010 – 2020 (DPIRD, 2021). Fishing effort has occurred in 10 nm CAES blocks 201161, 201163, 201164, 201165 and 202164 (DPIRD, 2021). Therefore, fishing effort could occur within the Operational Area in nearshore coastal waters.
Marine Aquarium Managed Fishery	✓	✓	✓	The Operational Area overlaps with the management area for the Marine Aquarium Managed Fishery. Fishing effort has occurred within the Operational Area in 60 nm CAES block 20160 from 2010-2020 and 201540 from 2010 – 2013 (DPIRD, 2021). However, fishing effort was only reported within two 10 nm CAES of the Operational Area; 201165 in 2013 and 202164 in 2010 – 2019 (DPIRD, 2021). Therefore, fishing effort could occur within the Operational Area in nearshore coastal waters.
Nickol Bay Prawn Managed Fishery	✓	✓	✓	The Operational Area overlaps with the management area for the Nickol Bay Prawn Managed Fishery. Fishing effort has occurred within the Operational Area in 60 nm CAES blocks 20150 and 20160 from 2015 – 2020 (DPIRD, 2021). Fishing effort was not reported within the 10 nm CAES blocks of the Operational Area, however some 10 nm CAES blocks are unknown (DPIRD, 2021). Therefore, fishing effort could occur within the Operational Area in nearshore coastal waters.
South West Coast Salmon Managed Fishery	✓	✓	×	No fishing effort for the South West Coast Salmon Managed Fishery occurs north of the Perth metropolitan area. Therefore, no fishing effort occurs within or nearby to the Operational Area and Woodside considers there to be no potential for interaction with this fishery.
Specimen Shell Managed Fishery	✓	✓	✓	The Operational Area overlaps with the management area for the Specimen Shell Managed Fishery. Fishing effort has occurred within the Operational Area in 60 nm CAES block 20160 and 10 nm CAES block 21264 from 2010 – 2012 and 2018 (DPIRD, 2021). Therefore, fishing effort could occur within the Operational Area in nearshore coastal waters.

Fishery	Overlap with Operational Area	Overlap with EMBA	Potential for interaction during activity	
Pilbara Crab Managed Fishery	✓	✓	✓	The Operational Area overlaps with the management area for the Pilbara Crab Managed Fishery. Fishing effort has occurred within the Operational Area in 60 nm CAES block 20160 in 2015 – 2019 and 20150 in 2016 (DPIRD, 2021). Fishing effort within 10 nm CAES blocks is unknown (DPIRD, 2021). Therefore, fishing effort could occur within the Operational Area in nearshore coastal waters.
Beche-de-mer Fishery	✓	✓	×	The Operational Area overlaps with the management area for the Beche-de-mer Fishery. Fishing effort has occurred within the Operational Area in 60 nm CAES blocks 20150 and 20160 in 2010, 2014 and 2016 – 2019, however fishing effort was only reported within one 10 nm CAES block of the Operational Area (202164) in 2014 (DPIRD, 2021). Given that fishing effort is concentrated in nearshore coastal waters, and no fishing effort has occurred within the Operational Area in recent years, Woodside considers there to be no potential for interaction with this fishery.
Onslow Prawn Managed Fishery	✓	✓	×	The Operational Area overlaps with the management area for the Onslow Prawn Managed Fishery. Historic fishing effort was reported within the Operational Area in 60 nm CAES block 20150 in 2010 and 2011, however no fishing effort was reported within the 10 nm CAES blocks of the Operational Area, with fishing effort concentrated in nearshore coastal waters south-west of the Operational Area. Therefore, Woodside considers there to be no potential for interaction with this fishery.
Pearl Oyster Managed Fishery	✓	✓	×	The Operational Area overlaps with the management area for the Pearl Oyster Managed Fishery, however no fishing effort has occurred within the Operational Area in recent years (2010-2020) (DPIRD, 2021). Therefore, Woodside considers there to be no potential for interaction with this fishery.
West Australian Abalone Fishery	✓	✓	×	No fishing effort for the West Australian Abalone Fishery has occurred north of Moore River since 2011-2012 (Strain et al., 2018). Accordingly, Woodside considers there to be no potential for interaction with this fishery.

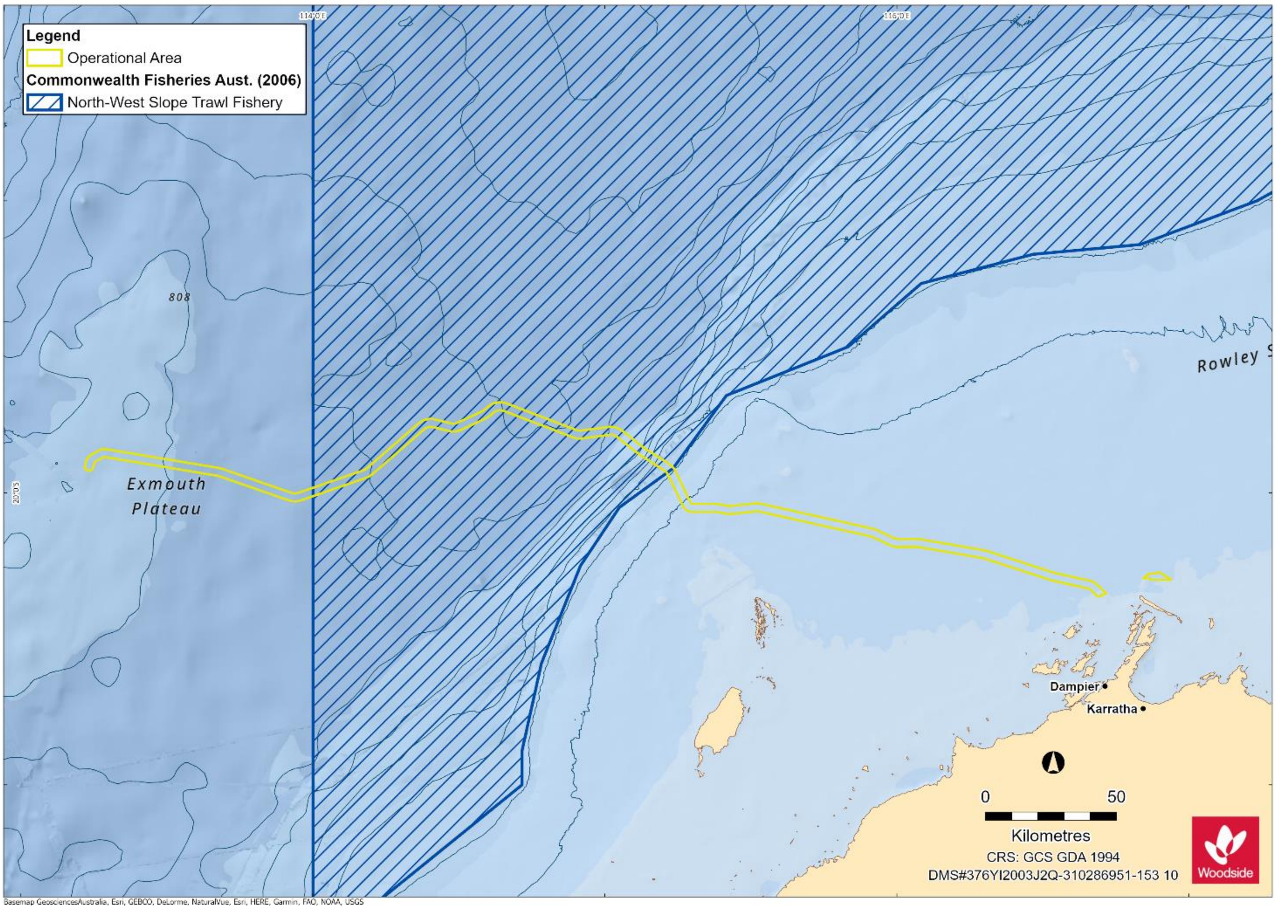


Figure 4-12: Commonwealth-managed commercial fisheries overlapping the Operational Area with a potential for interaction with the Petroleum Activities Program

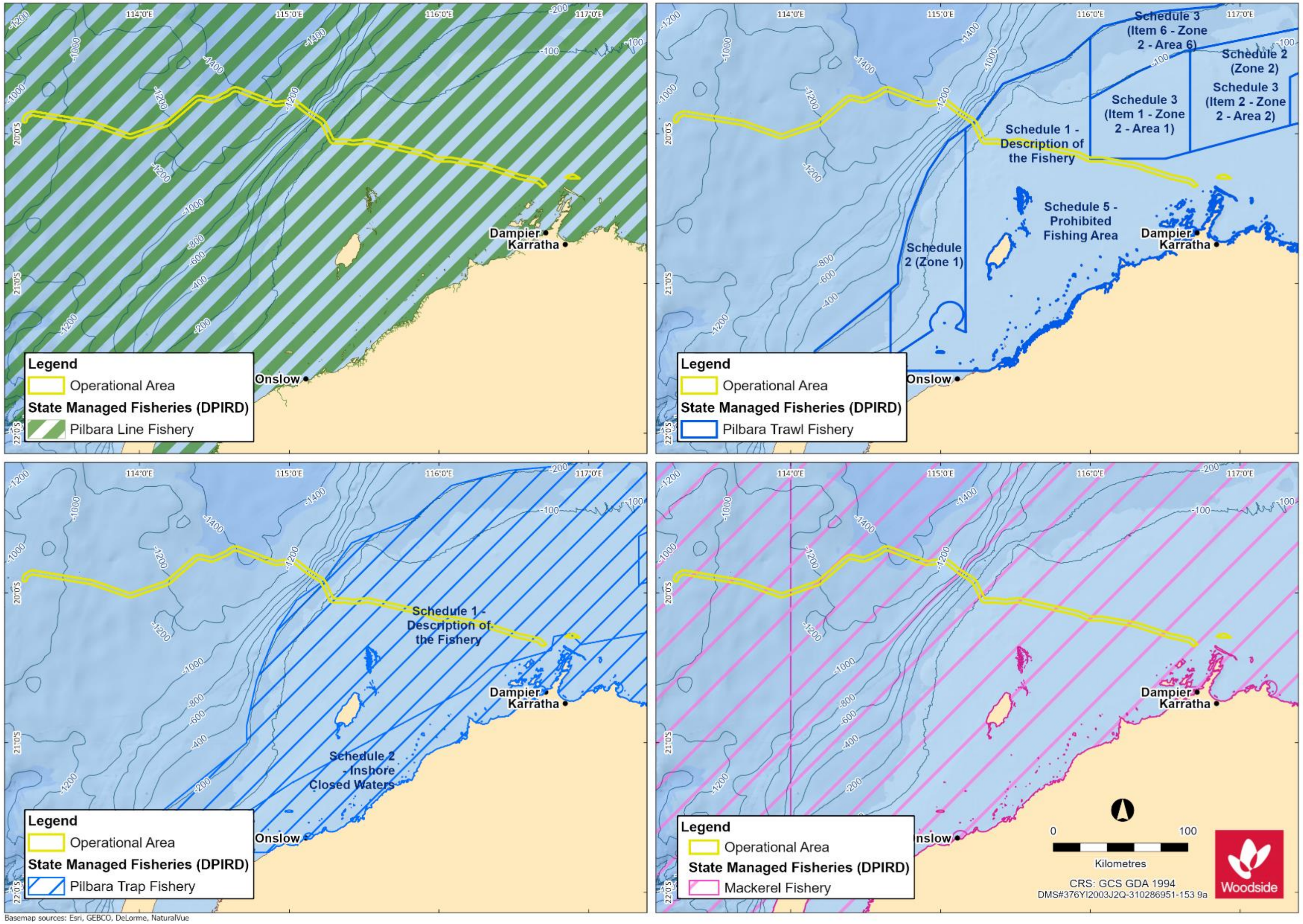


Figure 4-13: State-managed commercial fisheries overlapping the Operational Area with a potential for interaction with the Petroleum Activities Program

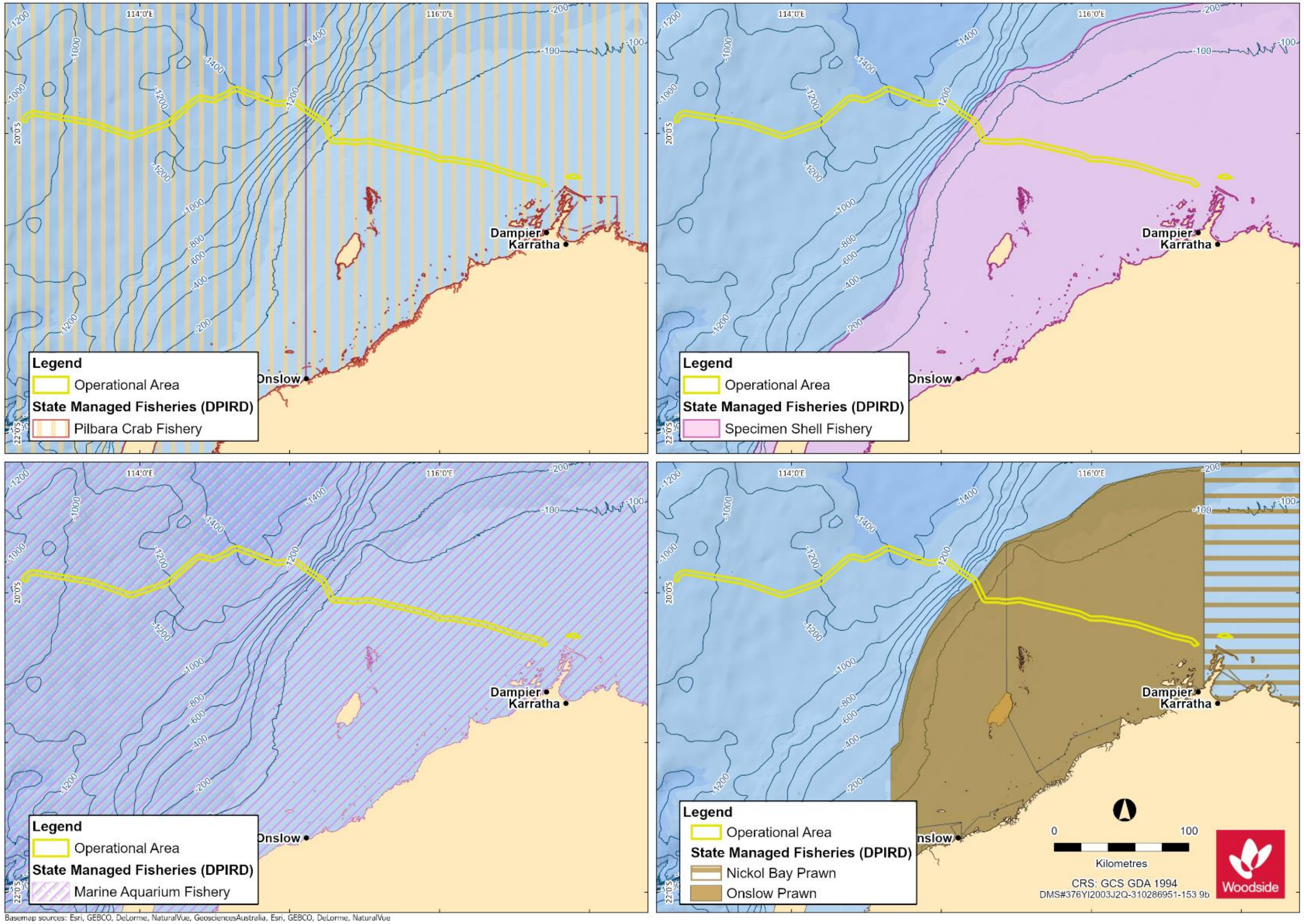


Figure 4-14: State-managed commercial fisheries overlapping the Operational Area with a potential for interaction with the Petroleum Activities Program

4.9.3 Traditional Fisheries

Due to the depth of the majority of the Operational Area, there is unlikely to be any traditional fisheries, with exception of shallower depths in the Trunkline Project Area near the State waters boundary. The coastal waters of the Dampier Archipelago, as well as the Montebello Islands, Ningaloo Reef and Barrow Island within the EMBA have a known history of traditional fishing.

4.9.4 Tourism and Recreation

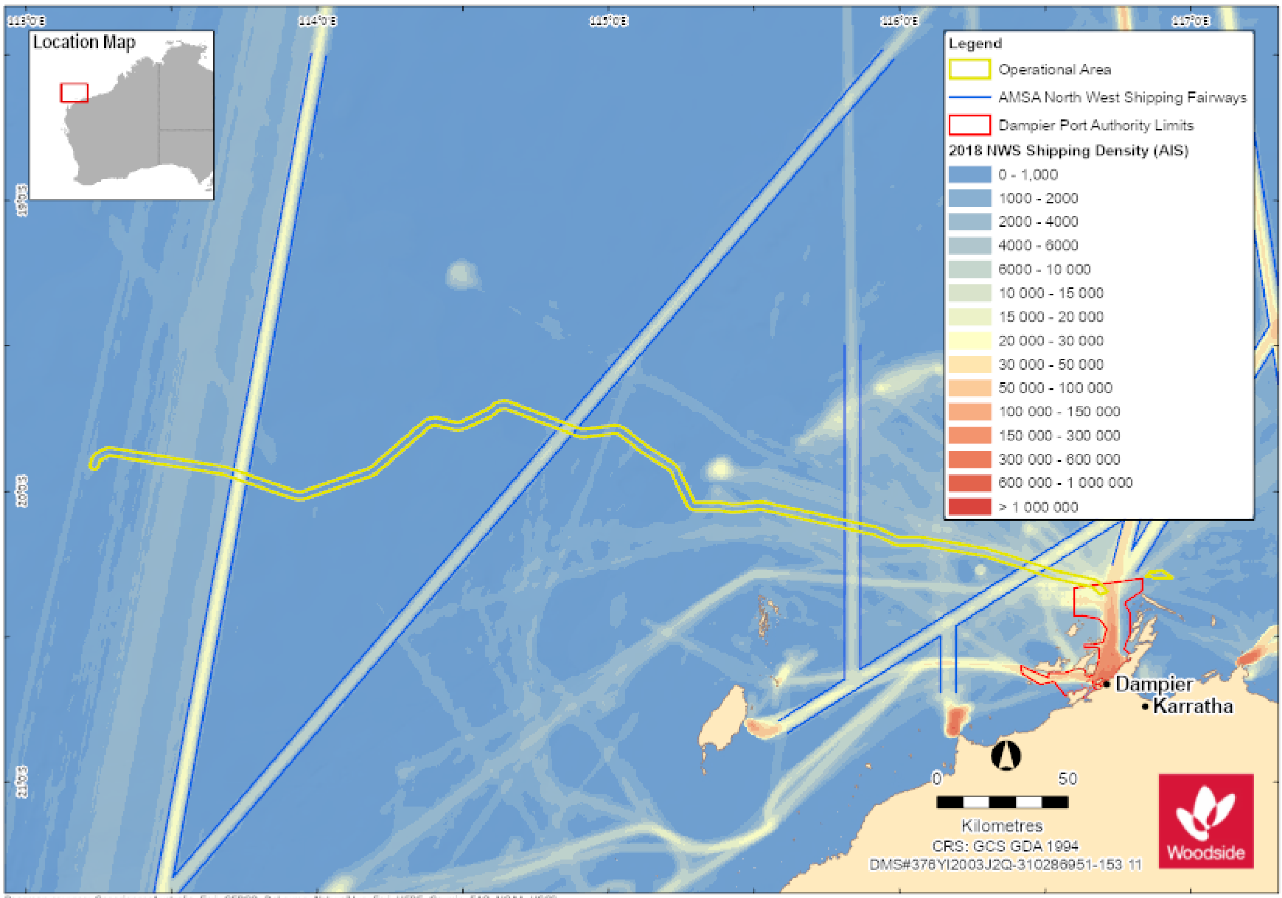
Tourism activities may occur in the Operational Area close to the Dampier Archipelago. However, the Operational Area is located far from most tourism activities in the NWMR. Recreational fishing may occur throughout the EMBA, primarily in continental shelf waters, around offshore islands and near shoreline areas. Dolphin and turtle watching tours may occur near the Dampier Archipelago within the EMBA. Cruise ships operate within the EMBA. Dive sites are located in a number of locations within the EMBA including Montebello Islands, and Rowley Shoals.

4.9.5 Commercial Shipping

The Australian Maritime Safety Authority (AMSA) has introduced a network of marine fairways across the NWMR off WA to reduce the risk of vessel collisions with offshore infrastructure. It is noted that a number of these fairways intersect with the Operational Area; the nearest shipping fairway is approximately 1 km to the north-west of the Operational Area (**Figure 4-15**).

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. The State waters adjacent to the easternmost point of the Trunkline Project Area falls within the boundaries of the Pilbara Ports Authority, within which the ports of Dampier and Port Hedland lie. Vessel tracking data suggest shipping is concentrated to the east of the Operational Area where increased vessel traffic will be associated with ports servicing the resource industry at Barrow Island, Onslow and Dampier (Section 11.8, **Appendix H**).

The Port of Dampier overlaps the EMBA (**Figure 4-15**) through the Dampier Archipelago and is a major industrial port in the north-west of WA. It is currently one of the world's largest bulk export port by tonnage and services the petrochemical, salt, iron ore and natural gas export industries. It is also the departure point for day cruises through the Dampier Archipelago.



Basemap sources: GeosciencesAustralia, Esri, GEBCO, DeLorme, NaturalVue, Esri, HERE, Garmin, FAO, NOAA, USGS

Figure 4-15; 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)

4.9.6 Oil and Gas

The Operations Area is located within the Exmouth Plateau area of the Northern Carnarvon Basin. There are a number of petroleum titles held by various title holders within the EMBA. The Trunkline Project Area intersects several existing oil and gas pipelines (**Table 3-8**) and several facilities are located within 50 km of the Operational Area (**Table 4-20**; **Figure 4-16**).

Table 4-20: Other oil and gas facilities located within 50 km of the Operational Area

Facility Name and Operator	Distance and direction from Operational Area to facility
Pluto Platform - Woodside	2 km north
Wheatstone Platform - Chevron	10 km north
Stag Platform - Jadestone	5 km south
Reindeer Platform - Santos	15 km north
Goodwyn Platform - Woodside	48 km north
Campbell Platform and Sinbad platform (Varanus hub) - Santos	50 km south

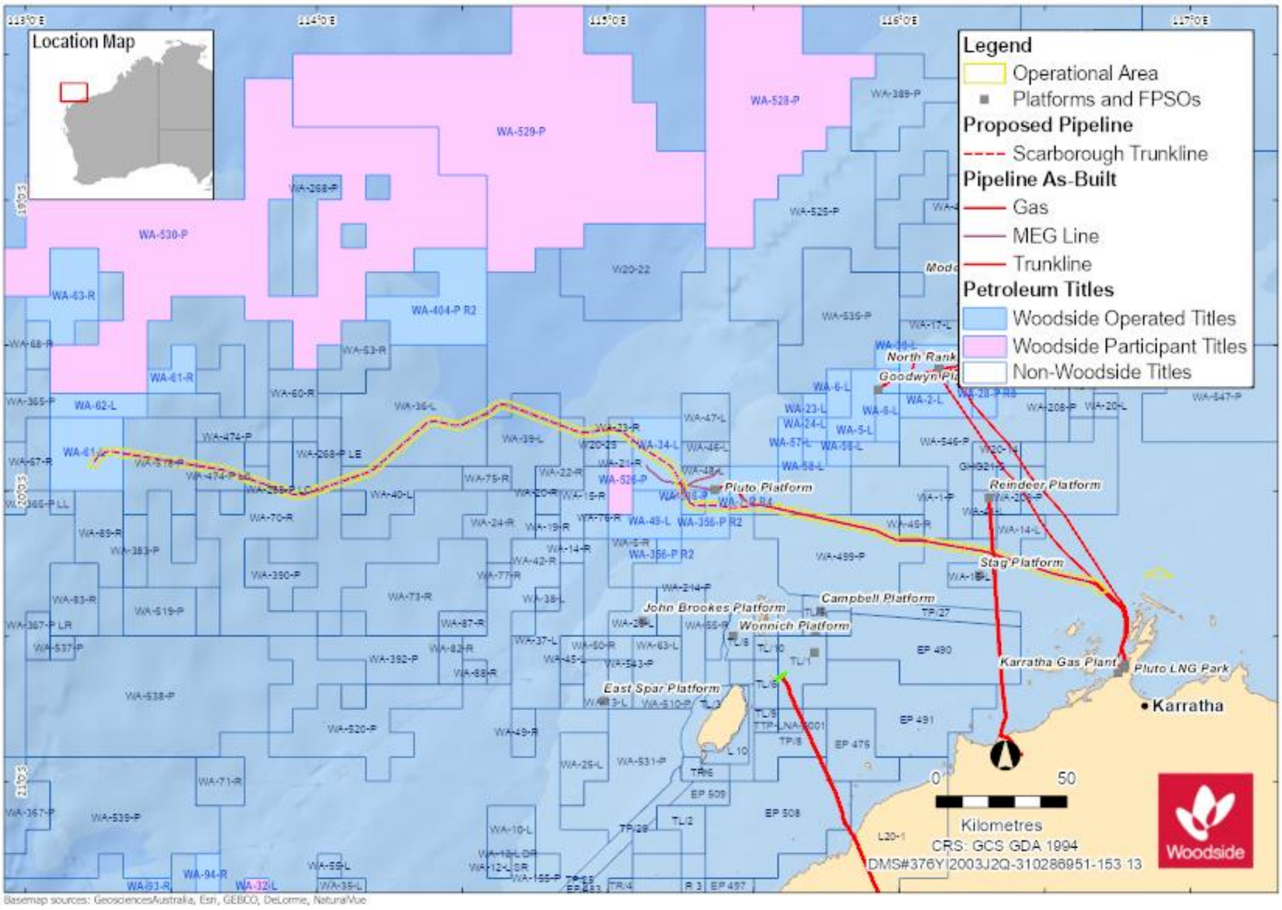


Figure 4-16: Oil and gas infrastructure and facilities within the Operational Area and EMBA

4.9.7 Defence

The Trunkline Project Area (from KP 120) and EMBA overlap the Defence Training Area associated with the Learmonth RAAF base. Defence areas overlapping the Operational Area and EMBA are presented in **Figure 4-17**.

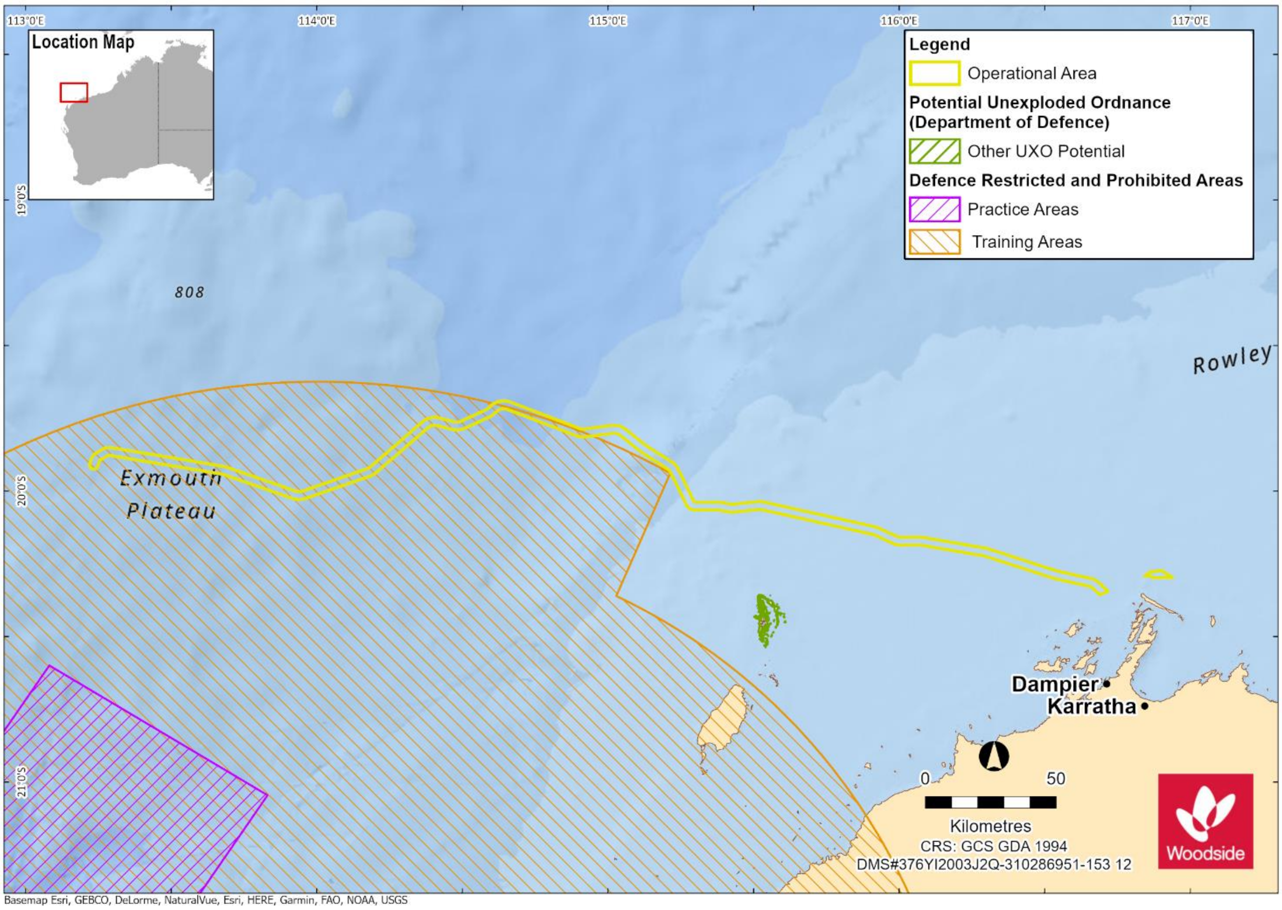


Figure 4-17: Defence areas within the Operational Area

5. STAKEHOLDER CONSULTATION

5.1 Summary

Woodside is committed to consulting relevant persons 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.

This includes consultation undertaken with regards to the Scarborough development through the OPP process.

5.2 Stakeholder Consultation Guidance

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

- each Department or agency of the Commonwealth Government to which the activities to be performed under the EP, or the revision of the EP, may be relevant
- each Department or agency of a State or the Northern Territory Government to which the activities to be performed under the EP, or the revision of the EP, may be relevant
- the Department of the responsible State Minister, or the responsible Northern Territory Minister
- a person or organisation whose functions, interests or activities may be affected by the activities to be performed under the EP, or the revision of the EP
- any other person or organisation that the Titleholder considers relevant.

Woodside's assessment of relevant persons to activities covered under this EP are outlined in **Table 5-1.**

5.3 Stakeholder Consultation Objectives

Woodside's objectives for consultation with relevant persons are to:

- improve relevant person awareness and understanding of the development of Scarborough
- provide relevant persons with opportunities to obtain information about Scarborough including the physical, ecological and socio-economic and cultural environment that may be affected, the potential impacts that may occur, and the prevention and mitigation measures proposed to avoid or minimise those impacts
- gain feedback from relevant persons on their concerns about the development of Scarborough and where possible, address concerns through further activities, or by implementing additional mitigation measures.

Preliminary consultation for the Scarborough OPP commenced with relevant persons in February 2018 as part of a planned, integrated and consistent approach to stakeholder engagement for a number of Woodside's proposed development opportunities (including the Browse to North West Shelf (NWS) Project, Scarborough, Pluto Train 2, NWS Project Extension and Pluto-NWS Interconnector). Consultation aims to be inclusive, transparent, voluntary, respectful and two-way. Consultation was completed by email, letter, phone call or meeting.

Consultation activities will continue to complement an overarching approach to stakeholder consultation for Woodside's development opportunities and project activities, and will be phased throughout project planning and execution. Woodside is employing a participatory approach, consulting relevant persons and gaining input into the identification and assessment of these impacts and opportunities.

5.4 Stakeholder Expectations for Consultation

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*
- *GN1488 - Oil pollution risk management - September 2020*
- *GL1887 - Consultation with Commonwealth agencies with responsibilities in the marine area – July 2020*

Australian Fisheries Management Authority:

- *Petroleum industry consultation with the commercial fishing industry*

Commonwealth Department of Agriculture, Water and the Environment:

- *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*

Additional relevant persons may be identified during consultation in the course of preparing the EP. These relevant persons will be contacted, provided relevant information to their interests and invited to provide feedback about the proposed activity. Woodside will review all feedback, provide a response and incorporate feedback into management of the proposed activity where necessary.

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

5.5 Relevant Person Identification

The process for consultation with relevant persons as undertaken by Woodside as the Operator of Scarborough included the identification of stakeholders and their relevance to the project. Table 5-1 presents a summary of stakeholders identified as relevant persons that are interested in, or likely to be affected by the development of Scarborough activities under the scope of this EP.

Relevant persons identified include those known as a result of Woodside's ongoing activities in Western Australia, as well as those identified through engagements with regulators, government agencies, desktop research and regional contacts.

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

Stakeholder	Relevant person to activity	Reasoning
Commonwealth Government department or agency		
Australian Border Force (ABF)	Yes	Responsible for coordinating maritime security.
Australian Fisheries Management Authority (AFMA)	Yes	Responsible for managing Commonwealth fisheries.
Australian Hydrographic Office (AHO)	Yes	Response for maritime safety and Notices to Mariners.
Australian Maritime Safety Authority (AMSA) – Shipping	Yes	Statutory agency for vessel safety and navigation and legislated responsibility for oil pollution response in Commonwealth waters.
Australian Maritime Safety Authority (AMSA) – Oil Spill	Yes	Legislated responsibility for oil pollution response in Commonwealth waters.
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.
Department of Defence (DoD)	Yes	Responsible for defending Australia and its national interests.
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 the management of Commonwealth parks and conservation zones.
WA Government department or agency		
Department of Biodiversity, Conservation and Attractions (DBCA)	Yes	Responsible for managing WA's parks, forests and reserves.
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.
Department of Transport (DoT)	Yes	Legislated responsibility for oil pollution response in State waters.
Pilbara Ports Authority	Yes	Responsible for the operation of the Port of Dampier.
Commonwealth fisheries*		
North-West Slope Trawl Fishery	Yes	The fishery overlaps with the Operational Area and there has been fishing effort within the last five years.
Southern Bluefin Tuna Fishery	No	Although the fishery overlaps the Operational Area, it has not been active in the Operational Area within the last five years. Fishing will not occur in the Operational Area. Australia has a 35% share of total global allowable catch of Southern Bluefin Tuna, which is value-added through tuna ranching near Port Lincoln (South Australia), or fishing effort in New South Wales (Australian Southern Bluefin Tuna Industry Association). However, Woodside has provided information on AFMA advice that it expects all Commonwealth fishers who have entitlements to fish within the proposed area to be consulted irrespective of the current status of fishing activity.

Stakeholder	Relevant person to activity	Reasoning
Western Deepwater Trawl Fishery	No	Although the fishery overlaps the Operational Area, it has not been active in the Operational Area within the last five years. However, Woodside has provided information on AFMA advice that it expects all Commonwealth fishers who have entitlements to fish within the proposed area to be consulted irrespective of the current status of fishing activity.
Western Tuna and Billfish Fishery	No	Although the fishery overlaps the Operational Area, it has not been active in the Operational Area within the last five years. However, Woodside has provided information on AFMA advice that it expects all Commonwealth fishers who have entitlements to fish within the proposed area to be consulted irrespective of the current status of fishing activity.
Western Skipjack Fishery	No	Although the fishery overlaps the Operational Area, it has not been active in the Operational Area within the last five years. However, Woodside has provided information on AFMA advice that it expects all Commonwealth fishers who have entitlements to fish within the proposed area to be consulted irrespective of the current status of fishing activity.
State fisheries*		
Mackerel Managed Fishery – Pilbara (Area 2 and 3)	Yes	The fishery overlaps with the Operational Area and there has been fishing effort within the last five years.
South West Coast Salmon Managed Fishery	No	Although the fishery overlaps the Operational Area, it has not been active in the Operational Area within the last five years. Fishers are active south of Perth and from the beach (previous WAFIC advice).
West Coast Deep Sea Crustacean Managed Fishery	No	Although the fishery overlaps the Operational Area, it has not been active in the Operational Area within the last five years. In recent years fishing has only been undertaken along the continental shelf edge and in waters south of Exmouth (West Coast Deep Sea Crustacean Managed Fishery; DPIRD, 2005).
Pilbara Crab Managed Fishery	Yes	The fishery overlaps with the Operational Area and there has been fishing effort within the last five years.
Marine Aquarium Fishery	Yes	Although the fishery overlaps the Operational Area, it has not been active in the Operational Area within the last five years. This is a dive and wade fishery with activities generally restricted to waters less than 30 m deep (previous WAFIC advice). Due to water depth of 32 m, Woodside has chosen to consult the Fishery.
Specimen Shell Fishery	Yes	The fishery overlaps with the Operational Area and there has been fishing effort within the last five years. This is a dive and wade fishery with activities generally restricted to waters less than 30 m deep (previous WAFIC advice). Due to water depth of 32 m, Woodside has chosen to consult the Fishery.
Abalone Managed Fishery	No	Although the fishery overlaps the Operational Area, however, no fishing effort has occurred north of Moore River since 2011-2012.
Onslow Prawn	No	Although the fishery overlaps the Operational Area, it has not been active in the Operational Area within the last five years.
Nickol Bay Prawn Managed Fishery	Yes	The fishery overlaps the Operational Area and DPRID data indicate active fishing within the Operational Area.
Beche-de-mer Fishery	No	Although the fishery overlaps the Operational Area, it has not been active in the Operational Area within the last five years.
Pearl Oyster Managed Fishery	No	Although the fishery overlaps the Operational Area, it has not been active in the Operational Area within the last five years.
	Yes	The fishery overlaps the Operational Area and DPRID data indicate active fishing within the Operational Area.

Stakeholder	Relevant person to activity	Reasoning
Pilbara Demersal Scalefish Fishery	Yes	The fishery overlaps the Operational Area and DPRID data indicate active fishing within the Operational Area.
• Pilbara Trawl Fishery • Pilbara Trap Fishery • Pilbara Line Fishery	Yes	The fishery overlaps the Operational Area and DPRID data indicate active fishing within the Operational Area.
Industry		
Chevron	Yes	Adjacent Titleholder.
Santos	Yes	Adjacent Titleholder.
Western Gas	Yes	Adjacent Titleholder.
Vermilion Oil & Gas	Yes	Adjacent Titleholder.
Jadestone Energy	Yes	Adjacent Titleholder.
KUFPEC	Yes	Adjacent Titleholder.
Industry representative organisations		
Australian Petroleum Production and Exploration Association (APPEA)	Yes	Represents the interests of oil and gas explorers and producers in Australia.
Commonwealth Fisheries Association (CFA)	Yes	Represents the interests of commercial fishers with licences in Commonwealth waters.
Southern Bluefin Tuna Industry Association	No	Woodside has provided information on AFMA advice that it expects all Commonwealth fishers who have entitlements to fish within the proposed area to be consulted irrespective of the current status of fishing activity.
Pearl Producers Association	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	Yes	Represents the interests of recreational fishers in WA.
Marine Tourism WA	Yes	Represents the interests of recreational fishers in WA.
WA Game Fishing Association	Yes	Represents the interests of charter owners and operators in WA.
Western Australian Fishing Industry Council (WAFIC)	Yes	Represents the interests of commercial fishers with licences in State Waters.
Other Relevant Persons		
Karratha based charter boat, tourism and dive operators	Yes	There has been effort in the Operational Area by charter boat operators within the last five years.
Karratha Community Liaison Group	Yes	Group established in 2002 to provide a forum for local community, industry and government stakeholders and the oil and gas industry to discuss operations and community issues.
Murujuga Aboriginal Corporation (MAC)	Yes	Woodside has engaged closely with MAC on the Scarborough project including, but not focusing on, activities in Commonwealth waters.
Conservation Council of WA (CCWA)	Yes	CCWA commented on the Scarborough OPP and during subsequent EP development self-identified as relevant, requesting to be consulted on Scarborough EPs. As a result of CCWA's expression of ongoing interest in Scarborough EPs, CCWA has been considered a relevant person for this EP. CCWA was provided with information consistent with all other relevant persons.

5.6 Consultation Approach

Woodside, as Operator of Scarborough has carried out a phased program of consultation:

- **Phase 1:** Preliminary consultation undertaken during the impact assessment process and preparation of the Scarborough OPP.
- **Phase 2**: Formal consultation under the public review process of the draft Scarborough OPP by NOPSEMA.
- **Phase 3**: Ongoing consultation during project planning and execution and development of activity specific Environment Plans.

Phase 1 (Preliminary Consultation) carried out as part of the Scarborough OPP consultation process, commenced in early 2018 and was built on the broader consultation and engagement processes that Woodside has in place for the region. It was undertaken up until the point of formal consultation under the Scarborough OPP process. It included tasks such as developing a dedicated project website, making available a Scarborough development fact sheet, hosting community forums and group meetings and providing information to key stakeholders such as approval submissions and progress against key milestones.

Phase 2 (Formal Scarborough OPP Consultation) ran from 5 July 2019 until 30 August 2019. It was determined by NOPSEMA that an 8-week formal consultation period would apply for the Scarborough OPP and all public comments were provided to NOPSEMA, who provided a copy of the comments received to Woodside. Following the public comment period, Woodside prepared a consultation report and final Scarborough OPP for assessment by NOPSEMA.

More details on Phase 1 and Phase 2 Scarborough development stakeholder consultation processes can be found in the Scarborough OPP (SA0006AF0000002, rev 5).

Relevant person consultation carried out for this and other Scarborough development Environment Plans represent Phase 3 (Ongoing Consultation) of the consultation approach.

5.7 Consultation with Relevant Persons

Consultation activities conducted for the proposed activity are outlined in **Table 5-2**.

The Consultation Information Sheet (App F, ref 1.2) is published on the Woodside website and includes a toll free 1800 phone number.

Table 5-2: Stakeholder consultation plan activities

Relevant person	Information provided	Response from relevant person	Woodside response	Woodside assessment and outcome
Australian Government department or agency				
ABF	On 31 August 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 it has provided sufficient information and opportunity to respond and considers this adequately addresses stakeholder interests.
AFMA	On 31 August 2021, Woodside emailed AFMA advising of the proposed activity (Appendix F, reference 1.16) and provided a Consultation Information Sheet and fisheries map.	On 1 September 2021, AFMA responded, noting that it cannot comment on individual proposals.	No response required.	Woodside has assessed the relevancy of Commonwealth fisheries issues in **Section 4.9.2** of this EP. Woodside has consulted with the Commonwealth Fishery Licence Holders. Woodside has consulted with CFA, DAWE and WAFIC. Woodside considers it has provided sufficient information and opportunity to respond and considers this adequately addresses stakeholder interests.

Relevant person	Information provided	Response from relevant person	Woodside response	Woodside assessment and outcome
AHS	On 31 August 2021, Woodside emailed AHS advising of the proposed activity (Appendix F, reference 1.4) and provided a Consultation Information Sheet and shipping lanes map (Appendix F, reference 1.5).	No feedback received	No response required.	Woodside will notify the AHS no less than four working weeks before operations commence, as referenced at **Control 3.1** in this EP. Woodside considers it has provided sufficient information and opportunity to respond and considers this adequately addresses stakeholder interests.
AMSA (marine safety)	On 31 August 2021, Woodside emailed ABF advising of the proposed activity (Appendix F, reference 1.4) and provided a Consultation Information Sheet and shipping lanes map (Appendix F, reference 1.5).	On 1 September 2021, AMSA emailed Woodside requesting: The AHS be contacted no less than four working weeks before operations commence for the promulgation of related notices to mariners. AMSA's Joint Rescue Coordination Centre (JRCC) be notified at least 24–48 hours before operations commence Provide updates to the AHS and JRCC should there be changes to the activity. Vessels exhibit appropriate lights and shapes to reflect the nature of operations and comply with the International Rules of Preventing Collisions at Sea. AMSA provided advice on obtaining vessel traffic plots, including digital datasets and maps.	No response required.	Woodside has addressed AMSA's requests: Woodside will notify AMSA's JRCC at least 24–48 hours before operations commence for each survey, as referenced as **Control 3.3** in this EP. Woodside will notify the AHS no less than four working weeks before operations commence, as referenced as a **Control 3.1** in this EP. Woodside considers this adequately addresses stakeholder interests and no further consultation is required.

Relevant person	Information provided	Response from relevant person	Woodside response	Woodside assessment and outcome
AMSA (marine pollution)	On 31 August 2021, Woodside emailed AMSA advising of the proposed activity (Appendix F, reference 1.4) and provided a Consultation Information Sheet and shipping lanes map (Appendix F, reference 1.5).	No feedback received.	No response required.	Woodside has addressed oil pollution planning and response at **Appendix D**. Woodside considers this adequately addresses stakeholder interests and no further consultation is required.
	On 5 November 2021, Woodside provided a copy of the Oil Pollution First Strike Plan to AMSA (Appendix F, reference 1.34)	No feedback received.	No response required.	
DAWE	On 31 August 2021, Woodside emailed DAWE advising of the proposed activity considering biosecurity matters (Appendix F, reference 1.6) and provided a Consultation Information Sheet and fisheries map.	No feedback received.	No response required.	Woodside has consulted CFA, AFMA, WAFIC and Commonwealth Fishery Licence Holders. Woodside has assessed the relevancy of Commonwealth fisheries issues in **Section 4.9.2** of this EP. Woodside has addressed maritime biosecurity issues in **Section 6** of this EP based on previous offshore activities. Woodside considers it has provided sufficient information and opportunity to respond and considers this adequately addresses stakeholder interests.

Relevant person	Information provided	Response from relevant person	Woodside response	Woodside assessment and outcome
DoD	On 31 August 2021, Woodside emailed DoD advising of the proposed activity (Appendix F, reference 1.7) and provided a Consultation Information Sheet and defence map (Appendix F, reference 1.8).	On 31 August 2021, DoD responded, noting it has previously responded regarding the proposed Scarborough Pipeline and associated activities, and that response remains current. The previous response included information about unexploded ordnance risks and DoD notification requirements prior to activity commencement.	No response required.	Woodside reviewed the proposed activity and the location of the NXWA and UXOs to understand the potential for UXOs to be within the Operational Area. The Learmonth Air Weapons Range (AWR) practice area is approximately 76 km south of the operational area and the location of any UXOs (known to occur) are near Bessieres Island which is located 165 km south of the Operational Area. A UXO survey may be carried out as part of pre-Trunkline installation work where there is deemed to be a credible risk. Woodside considers this adequately addresses stakeholder interests and no further consultation is required.
DISER	On 31 August 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 considers it has provided sufficient information and opportunity to respond and considers this adequately addresses stakeholder interests.
DNP	On 31 August 2021, Woodside emailed DNP advising of the proposed activity considering potential risks to Australian marine Parks (Appendix F, reference 1.3), and provided a Consultation Information Sheet.	Meeting held between Woodside and DNP on 13 September 2021. Woodside provided information relevant to DNP's interests.	On 20 September 2021, Woodside provided a copy of the presentation it presented on 13 September 2021.	Woodside has provided consultation to the DNP and addressed its comments. This EP demonstrates how Woodside will identify and manage all impacts and risks on Australian

Relevant person	Information provided	Response from relevant person	Woodside response	Woodside assessment and outcome
		On 6 October 2021, DNP responded, noting that the activities may affect the values present in the Dampier Marine Park Habitat Protection Zone and the National Park Zone. The DNP noted it has no objections and claims at this time. The DNP noted points relating to the Montebello Marine Park, Dampier Marine Park, cultural heritage, water quality monitoring and guidance information.	On 25 November 2021, Woodside responded to each of DNP's points with additional information.	marine park values (including ecosystem values) to an ALARP and acceptable level and that the activity is not inconsistent with the management plan (Section 6). Woodside will ensure DNP is made aware of any incidences within a marine park for the activity, as per the commitment in the Oil Pollution First Strike Plan. Woodside considers this adequately addresses stakeholder interests and no further consultation is required.
		On 1 December 2021, DNP responded, thanking Woodside for the additional information. DNP noted that based on the information provided to date (including modelling, risks identified, controls proposed and consultation outlined in the spreadsheet), the DNP has no objections and claims at this time and no further comments in relation to the proposed EP.	No response required.	
Western Australian Government department or agency or advisory body				
DBCA	On 31 August 2021, Woodside emailed DBCA advising of the proposed activity (Appendix F, reference 1.1) and provided a Consultation Information Sheet.	On 16 September 2021, DBCA responded, thanking Woodside for the opportunity to provide comment. DBCA noted that it has no comments.	No response required.	Woodside considers it has provided sufficient information and opportunity to respond and considers this adequately addresses stakeholder interests.

Relevant person	Information provided	Response from relevant person	Woodside response	Woodside assessment and outcome
DMIRS	On 31 August 2021, Woodside emailed DMIRS advising of the proposed activity (Appendix F, reference 1.1) and provided a Consultation Information Sheet.	On 24 September 2021, DMIRS responded, acknowledging receipt of the information. DMRIS noted that it does not required further information at this stage, and requested pre-start notifications confirming the start date of the proposed activity and a cessation notification upon completion of the activity.	No response required.	Woodside will provide notifications to DMIRS prior to the commencement and at the end of the activity. Woodside considers this adequately addresses stakeholder interests and no further consultation is required.
DPIRD	On 31 August 2021, Woodside emailed DPIRD advising of the proposed activity (Appendix F, reference 1.13) and provided a Consultation Information Sheet and fisheries map (Appendix F, reference 1.26 and 1.27).	No feedback received.	No response required.	Woodside has consulted CFA, AFMA, WAFIC and Commonwealth Fishery Licence Holders. Woodside considers it has provided sufficient information and opportunity to respond and considers this adequately addresses stakeholder interests.
DoT	On 31 August 2021, Woodside emailed DoT advising of the proposed activity (Appendix F, reference 1.1) and provided a Consultation Information Sheet.	On 3 September 2021, DoT responded, advising that if there is a risk of a spill impacting State water from the proposed activities, DoT should be consulted.	No response required.	Woodside has addressed oil pollution planning and response at **Appendix D**. Woodside will consult DoT if there is a risk of a spill impacting State waters. Woodside will provide DoT with a copy of the final accepted Oil Pollution First Strike Plan. Woodside considers this adequately addresses stakeholder interests and no further consultation is required
	On 5 November 2021, Woodside provided a copy of the Oil Pollution First Strike Plan to DoT (Appendix F, reference 1.35)	On 7 December 2021, DOT responded, noting it does not have any queries, and requested the final accepted version of the Oil Pollution First Strike Plan when available.	On 7 December 2021, Woodside responded, and noted it would provide a copy of the Oil Pollution First Strike Plan once approved.	

Relevant person	Information provided	Response from relevant person	Woodside response	Woodside assessment and outcome
Pilbara Ports Authority	On 31 August 2021, Woodside emailed the Pilbara Ports Authority advising of the proposed activity (Appendix F, reference 1.22) and provided a Consultation Information Sheet and a fisheries map (Appendix F, reference 1.26).	On 3 September the Pilbara Ports Authority emailed Woodside, noting it had previously provided feedback on consultation on the overall project. The Pilbara Ports Authority requested confirmation the feedback had been recorded and noted its comments were relevant to both EPs.	Woodside organised a meeting with Pilbara Ports Authority for 5 October 2021.	Woodside has provided consultation to the Pilbara Ports Authority relevant to its interests and addressed its comments. Woodside will provide a copy of the First Strike Oil Plan once approved. Woodside considers this adequately addresses stakeholder interests and no further consultation is required.
		On 10 September 2021 Pilbara Ports Authority responded requesting information on: The risks of the activities being conducted in Port waters What controls / mitigation strategies will be in place What monitoring programs will be in place Incident reporting requirements	On 5 October 2021, Woodside held an information session with Pilbara Ports Authority to address their interests and to provide more detail regarding installation activities and impacts relevant to Pilbara Ports Authority's areas of interest.	
		On 5 November 2021, Pilbara Ports Authority responded, thanking Woodside for the Plan and noted it will review and provide a response in the following weeks. On 15 November 2021, Pilbara Ports Authority emailed Woodside with feedback on five sections of the Plan.	On 26 November 2021, Woodside provided a response to the Pilbara Port Authority's feedback, noting all points were amended in line with its feedback.	
Industry				

Relevant person	Information provided	Response from relevant person	Woodside response	Woodside assessment and outcome
Chevron	On 31 August 2021, Woodside emailed Chevron advising of the proposed activity (Appendix F, reference 1.17) and provided a Consultation Information Sheet and Titleholder map (Appendix F, reference 1.18).	No feedback received.	No response required.	Woodside considers it has provided sufficient information and opportunity to respond and considers this adequately addresses stakeholder interests.
Santos	On 31 August 2021, Woodside emailed Santos advising of the proposed activity (Appendix F, reference 1.17) and provided a Consultation Information Sheet and Titleholder map (Appendix F, reference 1.18).	No feedback received.	No response required.	Woodside considers it has provided sufficient information and opportunity to respond and considers this adequately addresses stakeholder interests.
Western Gas	On 31 August 2021, Woodside emailed Western Gas advising of the proposed activity (Appendix F, reference 1.17) and provided a Consultation Information Sheet and Titleholder map (Appendix F, reference 1.18).	No feedback received.	No response required.	Woodside considers it has provided sufficient information and opportunity to respond and considers this adequately addresses stakeholder interests.
Vermilion Oil & Gas	On 31 August 2021, Woodside emailed Vermilion Oil & Gas advising of the proposed activity (Appendix F, reference 1.17) and provided a Consultation Information Sheet and Titleholder map (Appendix F, reference 1.18).	On 5 October 2021, Vermilion responded, noting it did not have issue with the current plan.	No response required.	Woodside considers it has provided sufficient information and opportunity to respond and considers this adequately addresses stakeholder interests.
Jadestone Energy	On 31 August 2021, Woodside emailed Jadestone Energy advising of the proposed activity (Appendix F, reference 1.17) and provided a Consultation Information Sheet and Titleholder map (Appendix F, reference 1.18).	No feedback received.	No response required.	Woodside considers it has provided sufficient information and opportunity to respond and considers this adequately addresses stakeholder interests.

Relevant person	Information provided	Response from relevant person	Woodside response	Woodside assessment and outcome
KUFPEC	On 31 August 2021, Woodside emailed KUFPEC advising of the proposed activity (Appendix F, reference 1.17) and provided a Consultation Information Sheet and Titleholder map (Appendix F, reference 1.18).	No feedback received.	No response required.	Woodside considers it has provided sufficient information and opportunity to respond and considers this adequately addresses stakeholder interests.
Industry representative organisations				
APPEA	On 31 August 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 considers it has provided sufficient information and opportunity to respond and considers this adequately addresses stakeholder interests.
CFA	On 31 August 2021, Woodside emailed the CFA advising of the proposed activity (Appendix F, reference 1.16) and provided a Consultation Information Sheet and a fisheries map (Appendix F, reference 1.26 and 1.27).	No feedback received.	No response required.	Woodside has consulted relevant Commonwealth fishery stakeholders including AFMA, DAWE and WAFIC. Woodside has assessed the relevance of Commonwealth fisheries issues in **Section 4.9.2** of this EP. Woodside has consulted with Commonwealth Fishery Licence Holders. Woodside considers this adequately addresses stakeholder interests and no further consultation is required.

Relevant person	Information provided	Response from relevant person	Woodside response	Woodside assessment and outcome
	On 5 November 2021, Woodside provided a copy of the Oil Pollution First Strike Plan to Pilbara Ports Authority (Appendix F, reference 1.35)	On 2 December 2021, Pilbara Ports Authority responded, confirming it was happy with the changes.	On 2 December 2021, Woodside responded, noting the Pilbara Ports Authority's acceptance of the amendments, and confirmed it would send the Pilbara Ports Authority a copy of the final plan once approved.	
Recfishwest	On 31 August 2021, Woodside emailed Recfishwest advising of the proposed activity (Appendix F, reference 1.1) and provided a Consultation Information Sheet.	No feedback received.	No response required.	Woodside has consulted WA Game Fishing Club, Marine Tourism Association of WA and individual relevant charter operators. Woodside considers it has provided sufficient information and opportunity to respond and considers this adequately addresses stakeholder interests. Woodside will continue to consult with Recfishwest on the Scarborough Project prior to and during the execution of activities.
Marine Tourism Association of WA	On 31 August 2021, Woodside emailed Marine Tourism advising of the proposed activity (Appendix F, reference 1.1) and provided a Consultation Information Sheet.	No feedback received.	No response required.	Woodside considers it has provided sufficient information and opportunity to respond and considers this adequately addresses stakeholder interests.
WA Game Fishing Association	On 31 August 2021, Woodside emailed the WA Game Fishing Association advising of the proposed activity (Appendix F, reference 1.14) and provided a Consultation Information Sheet.	No feedback received.	No response required.	Woodside considers it has provided sufficient information and opportunity to respond and considers this adequately addresses stakeholder interests.

Relevant person	Information provided	Response from relevant person	Woodside response	Woodside assessment and outcome
WAFIC	On 31 August 2021, Woodside emailed WAFIC advising of the proposed activity (Appendix F, reference 1.9) and provided a Consultation Information Sheet and fisheries map (Appendix F, reference 1.26 and 1.27).	On 10 September 2021, WAFIC responded, thanking Woodside for the information and requested the cumulative impact assessment for commercial fishing.	Woodside held meeting with WAFIC on 18 October 2021 and discussed information relevant to WAFIC's interests.	Woodside has consulted with WAFIC and provided information relevant to WAFIC's interests. Woodside has consulted with relevant Commonwealth and State Fishery Licence Holders, CFA, AFMA and DAWE. Woodside considers this adequately addresses stakeholder interests and no further consultation is required
		On 19 October 2021, WAFIC emailed Woodside, asking for additional information on: Dredge volume A map of dredge spoil ground During the pipeline installation, the expected time for the plume associated with seabed disturbance to settle after installation Whether Woodside has considered fish spawning times during the development of the timing of the pipeline installation Whether Woodside has considered the peak fishing times of commercial fishers, based on historical catch and effort data to avoid disturbance to commercial fishing operations WAFIC also noted that notifications to stakeholders during this installation campaign will be very important and is happy to work with Woodside to work through the best approach for communicating with the commercial fishing industry.	On 28 October 2021, Woodside responded to WAFIC's requests for additional information and provided a map of the spoil ground.	

Relevant person	Information provided	Response from relevant person	Woodside response	Woodside assessment and outcome
		On 23 November 2021, WAFIC emailed Woodside and asked for confirmation whether any feedback had been received from individual fishers. WAFIC also noted it was referring to the impacts from dredging plume impacts to spawning fish and/or areas closed such as a nursery area.	On 6 December 2021, Woodside confirmed that no feedback had been received from individual fishers and provided additional information on fish spawning and potential impacts and risks.	
Pearl Producers Association	On 31 August 2021, Woodside emailed Pearl Producers Association advising of the proposed activity (Appendix F, reference 1.15) and provided a Consultation Information Sheet and Commonwealth Fisheries Map (Appendix F, reference 1.26 and 1.27).	No feedback received.	No response required.	Woodside considers it has provided sufficient information and opportunity to respond and considers this adequately addresses stakeholder interests.
Southern Bluefin Tuna Industry Association (ASBTIA)	On 31 August 2021, Woodside emailed ASBTIA advising of the proposed activity (Appendix F, reference 1.19) and provided a Consultation Information Sheet and Commonwealth Fisheries Map (Appendix F, reference 1.26).	No feedback received.	No response required.	Woodside has consulted Southern Bluefin Tuna fishery licence holders and ASBTIA. Woodside considers it has provided sufficient information and opportunity to respond and considers this adequately addresses stakeholder interests.
Commonwealth fisheries				
North-West Slope Trawl Fishery	On 31 August 2021, Woodside emailed Licence Holders advising of the proposed activity (Appendix F, reference 1.11) and provided a Consultation Information Sheet and Commonwealth Fisheries Map (Appendix F, reference 1.26).	No feedback received.	No response required.	Woodside considers it has provided sufficient information and opportunity to respond and considers this adequately addresses stakeholder interests.
Southern Bluefin Tuna Fishery	On 31 August 2021, Woodside emailed Licence Holders advising of	No feedback received.	No response required.	Woodside considers it has provided sufficient information and

Relevant person	Information provided	Response from relevant person	Woodside response	Woodside assessment and outcome
	the proposed activity (Appendix F, reference 1.11) and provided a Consultation Information Sheet and Commonwealth Fisheries Map (Appendix F, reference 1.26).			opportunity to respond and considers this adequately addresses stakeholder interests.
Western Deepwater Trawl Fishery	On 31 August 2021, Woodside emailed Licence Holders advising of the proposed activity (Appendix F, reference 1.11) and provided a Consultation Information Sheet and Commonwealth Fisheries Map (Appendix F, reference 1.26).	No feedback received.	No response required.	Woodside considers it has provided sufficient information and opportunity to respond and considers this adequately addresses stakeholder interests.
Western Tuna and Billfish Fishery	On 31 August 2021, Woodside emailed Licence Holders advising of the proposed activity (Appendix F, reference 1.11) and provided a Consultation Information Sheet and Commonwealth Fisheries Map (Appendix F, reference 1.26).	No feedback received.	No response required.	Woodside considers it has provided sufficient information and opportunity to respond and considers this adequately addresses stakeholder interests.
Western Skipjack Fishery	On 31 August 2021, Woodside emailed Licence Holders advising of the proposed activity (Appendix F, reference 1.11) and provided a Consultation Information Sheet and Commonwealth Fisheries Map (Appendix F, reference 1.26).	No feedback received.	No response required.	Woodside considers it has provided sufficient information and opportunity to respond and considers this adequately addresses stakeholder interests.
State fisheries				
Mackerel Managed Fishery – Pilbara (Area 2 and 3)	On 1 September 2021, Woodside mailed letters to Licence Holders advising of the proposed activity (Appendix F, reference 1.12) and provided a Consultation Information Sheet and Commonwealth Fisheries Map (Appendix F, reference 1.28).	No feedback received.	No response required.	Woodside considers it has provided sufficient information and opportunity to respond and considers this adequately addresses stakeholder interests.
Pilbara Crab Managed Fishery	On 1 September 2021, Woodside mailed letters to Licence Holders	No feedback received.	No response required.	Woodside considers it has provided sufficient information and

Relevant person	Information provided	Response from relevant person	Woodside response	Woodside assessment and outcome
	advising of the proposed activity (Appendix F, reference 1.12) and provided a Consultation Information Sheet and Commonwealth Fisheries Map (Appendix F, reference 1.30).			opportunity to respond and considers this adequately addresses stakeholder interests.
Marine Aquarium Fishery	On 1 September 2021, Woodside mailed letters to Licence Holders advising of the proposed activity (Appendix F, reference 1.12) and provided a Consultation Information Sheet and Commonwealth Fisheries Map (Appendix F, reference 1.31).	No feedback received.	No response required.	Woodside considers it has provided sufficient information and opportunity to respond and considers this adequately addresses stakeholder interests.
Specimen Shell Fishery	On 1 September 2021, Woodside mailed letters to Licence Holders advising of the proposed activity (Appendix F, reference 1.12) and provided a Consultation Information Sheet and Commonwealth Fisheries Map (Appendix F, reference 1.29).	No feedback received.	No response required.	Woodside considers it has provided sufficient information and opportunity to respond and considers this adequately addresses stakeholder interests.
Nickol Bay Prawn Managed Fishery	On 1 September 2021, Woodside mailed letters to Licence Holders advising of the proposed activity (Appendix F, reference 1.12) and provided a Consultation Information Sheet and Commonwealth Fisheries Map (Appendix F, reference 1.32).	No feedback received.	No response required.	Woodside considers it has provided sufficient information and opportunity to respond and considers this adequately addresses stakeholder interests.
Pilbara Trawl Fishery	On 31 August 2021, Woodside emailed Licence Holders advising of the proposed activity (Appendix F, reference 1.10) and provided a Consultation Information Sheet and Commonwealth Fisheries Map (Appendix F, reference 1.27).	No feedback received.	No response required.	Woodside considers it has provided sufficient information and opportunity to respond and considers this adequately addresses stakeholder interests.
Pilbara Trap Fishery	On 31 August 2021, Woodside emailed Licence Holders advising of the proposed activity (Appendix F, reference 1.10) and provided a	No feedback received.	No response required.	Woodside considers it has provided sufficient information and opportunity to respond and

Relevant person	Information provided	Response from relevant person	Woodside response	Woodside assessment and outcome
	Consultation Information Sheet and Commonwealth Fisheries Map (Appendix F, reference 1.27).			considers this adequately addresses stakeholder interests.
Pilbara Line Fishery	On 31 August 2021, Woodside emailed Licence Holders advising of the proposed activity (Appendix F, reference 1.10) and provided a Consultation Information Sheet and Commonwealth Fisheries Map (Appendix F, reference 1.27).	No feedback received.	No response required.	Woodside considers it has provided sufficient information and opportunity to respond and considers this adequately addresses stakeholder interests.
Other relevant persons				
Karratha based charter boat, tourism and dive operators	On 31 August 2021, Woodside emailed Karratha based charter boat, tourism and diver operators, advising of the proposed activity (Appendix F, reference 1.14) and provided a Consultation Information Sheet.	No feedback received.	No response required.	Woodside considers it has provided sufficient information and opportunity to respond and considers this adequately addresses stakeholder interests.
Karratha Community Reference Group	On 31 August 2021, Woodside emailed the Karratha Community Reference Group advising of the proposed activity (Appendix F, reference 1.22, 1.23, 1.24 and 1.20) and provided a Consultation Information Sheet.	Response received from Pilbara Ports Authority (see above). No feedback received from other members.	No response required.	Woodside considers it has provided sufficient information and opportunity to respond and considers this adequately addresses stakeholder interests.

Relevant person	Information provided	Response from relevant person	Woodside response	Woodside assessment and outcome
Murujuga Aboriginal Corporation (MAC)	On 31 August 2021, Woodside emailed MAC advising of the proposed activity (Appendix F, reference 1.20) and provided a Consultation Information Sheet.	No feedback received.	Woodside proposed an additional meeting with MAC in late November 2021 to discuss this EP. MAC was unable to facilitate a meeting within the requested timeframe.	Woodside held several meetings with MAC during 2020 and 2021 on the Scarborough trunkline (State and Commonwealth). Woodside, in consultation with MAC, engaged submerged heritage experts to assess the prospectivity for archaeological sites along the entirety of the Scarborough pipeline route and its development envelope. Woodside has also commissioned MAC to undertake ethnographic surveys of the submerged landscape. No heritage sites have been identified Woodside will continue to consult with MAC on all relevant aspects of this EP and related Management Plans prior to and during the execution of activities.
Conservation Council of WA (CCWA)	In response to CCWA's request to be consulted on Scarborough EPs (12 August 2021), Woodside emailed CCWA on 31 August 2021 advising of the proposed activity (Appendix F, reference 1.25) and provided a Consultation Information Sheet.	No feedback on this EP received.	No response required.	CCWA has commented on the Scarborough Offshore Project proposal (OPP), accepted by NOPSEMA on 30 March 2020. The OPP provides a significant amount of information in relation to all activities associated with the proposed Scarborough Project. Woodside will continue to consult with CCWA in relation to feedback received during each Scarborough EP consultation process.

Relevant person	Information provided	Response from relevant person	Woodside response	Woodside assessment and outcome
				Woodside considers it has provided sufficient information and opportunity to respond and considers this adequately addresses stakeholder interests relevant to this petroleum activity.

5.8 Ongoing Stakeholder Consultation

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

Table 5-3: Ongoing stakeholder consultation

Stakeholder	Activity
AHS	Woodside will notify the AHS no less than four weeks before operations commence and provide updates to AHS on any changes to planned activities.
AMSA	Woodside will notify AMSA's JRCC at least 24-48 hours before operations commence.
DMIRS	Woodside will send DMIRS commencement and cessation notifications.
DNP	Woodside will contact the DNP in the event of an emergency response.
DoD	Woodside will notify DoD five weeks before operations.
DoT	Woodside will provide DoT with a copy of the final accepted Oil Pollution First Strike Plan.
	Woodside will consult DoT if there is a spill impacting State water from the proposed activity.
MAC	Woodside will continue to consult with MAC on all relevant aspects of this EP and related Management Plans prior to and during the execution of activities.
Pilbara Ports Authority	Woodside will provide Pilbara Ports Authority with a copy of the final accepted Oil Pollution First Strike Plan.
Relevant fisheries as identified in **Table 5-1**	Woodside will send relevant fishery licence holders commencement and cessation notifications.
Third party infrastructure operators	Woodside will notify third party infrastructure operators prior to crossing construction work commencing.

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

6.1 Overview

This section presents the impact and risk analysis, evaluation and Environment Performance Outcomes (EPO's), Environmental Performance Standards (EPS) and Measurement Criteria (MC) for the Petroleum Activities Program, using the methodology described in **Section 6** of this EP.

6.2 Impact and Risk Analysis and Evaluation

As required by Regulations 13(5) and 13(6) of the Environment Regulations, the following analysis and evaluation demonstrates that the identified impacts and risks associated with the Petroleum Activities Program are reduced to ALARP, are of an acceptable level and consider all operations of the activity, including potential emergency conditions. The impact assessment for planned activities has been based on the size of the Operational Area.

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

- Planned activities (routine and non-routine) that have the potential for inherent environmental impacts.
- Unplanned events (accidents, incidents or emergency situations) with an environmental consequence, termed risks.

Within these categories, impact and risk assessment groupings are based on environmental aspects such as emissions and physical presence. In all cases, the worst-case risk was assumed.

The ENVID (performed in accordance with the methodology described in **Section 2**) identified 15 sources of environmental impacts and risks. A summary of the ENVID is provided in **Table 6-2.**

The activity specific ENVID workshop was conducted on 22 June 2021. Attendees included Woodside environment advisers and engineers, environmental scientists, hydrocarbon spill advisers, trunkline engineer and manager, and seabed intervention manager. Representatives from the seabed intervention and trunkline installation contractors were also present. The participants' breadth of knowledge, training and experience was sufficient to reasonably assure that the hazards that may arise in connection with the petroleum activity in this EP were identified.

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

6.2.1 Cumulative Impacts

The Scarborough OPP (SA0006AF0000002, Rev 5; Section 8) assesses the potential cumulative impact of the Scarborough Project and other activities / developments. In addition, Woodside has assessed the cumulative impacts of the Petroleum Activities Program in relation to other relevant petroleum activities, including other Scarborough activities, that could realistically result in overlapping temporal and spatial extents.

Other facilities located in proximity to the Operational Area were identified within **Section 4.9.6**. While there may be spatial overlap with a number of pipelines and cables, activities cannot occur concurrently and therefore, no cumulative risks or impacts will credibly occur.

Woodside has also identified and assessed in this EP the following proposed activities that may overlap temporally and/or spatially with the PAP:

- Scarborough D&C program (in WA-61-L) may result in cumulative impacts due to both spatial and temporal overlaps.

In this EP, cumulative impact assessment has been carried out for:

- Routine acoustic emissions
- Physical Presence (Unplanned) – Interaction with Marine Fauna

6.3 Environmental Performance Outcomes, Standards and Measurement Criteria

Regulation 13(7) of the Environment Regulations requires that an EP includes Environmental Performance Outcomes (EPOs), Environmental Performance Standards (EPSs) and Measurement Criteria (MC) that address legislative and other controls to manage the environmental risks of the activity to ALARP and acceptable levels.

The EPOs, EPSs and MC specified are consistent with legislative requirements and Woodside's standards and procedures. They have been developed based on the Codes and Standards, Good Industry Practices and Professional Judgement outlined in **Section 2.2.3** and **Section 2.2.4** as part of the acceptability and ALARP justification process.

The EPOs, EPSs and MC are presented throughout this section and in **Appendix D** (Oil Spill Preparedness and Response). A breach of these EPOs or standards constitutes a 'Recordable Incident' under the Environment Regulations (refer to **Section 7.13.4**).

The Scarborough OPP identified the impacts and risks associated with the proposed development and defined suitable high-level Environmental Performance Outcomes. The Scarborough OPP EPOs have been cascaded to the relevant project activities under this EP and the relationship between OPP EPOs and those developed in this EP is also summarized in **Table 6-1.**

For the physical and biological receptors within the EMBA, Woodside has set EPOs that are consistent with the *Matters of National Environmental Significance – Significant impact guidelines 1.1* (Commonwealth of Australia, 2013). For social receptors, including fishing and other commercial activities, the EPOs that have been set reflect the requirements in the OPGGS Act Section 280(2), in that the activities undertaken as a part of the development of Scarborough should not interfere with other marine users, to a greater extent than is necessary for the exercise of right conferred by the titles granted.

The EPOs for all environmental impacts/risks are identified and summarised in **Table 6-1.**

Table 6-1: Comparison of EP EPOs to the relevant OPP EPOs

Aspect	EPOs in this EP	Relevant EPOs from the Scarborough OPP	Comparison
Planned Activities			
Section 6.6.1 Physical Presence – Interactions with Other Marine Users	**EPO 1** Undertake the Petroleum Activities Program in a manner that will not have a substantial adverse effect on the sustainability of commercial fishing.	**EPO 5.1**	The EPOs adopted in the EP for the interference with other users are consistent with the EPOs in the Scarborough OPP.
	EPO 2 Undertake the Petroleum Activities Program in a manner that does not interfere with other marine users to a greater extent than is necessary for the exercise of right conferred by the titles granted.	**EPO 5.2**	
Section 6.6.2 Physical Presence – Seabed Disturbance (Dredging, Spoil Disposal and Backfill)	**EPO 3** Undertake the Petroleum Activities Program in a manner that does not result in a substantial change in water quality which may adversely impact on biodiversity, ecological integrity, social amenity or human health.	**EPO 6.1; EPO 7.1 ; EPO 8.1; EPO 9.1; EPO 10.1; EPO12.1; EPO 13.1; EPO 14.1; EPO 15.2**	The EPOs adopted in the EP for seabed disturbance are consistent with the EPOs in the Scarborough OPP.
	EPO 4 Undertake activities within the borrow ground to not harm or cause destruction to the sea floor habitats (including significant areas of sponge habitat) of the Dampier AMP Habitat Protection Zone.	**EPO 6.2**	
	EPO 5 Undertake the Petroleum Activities Program in a manner that aims to avoid the displacement of marine turtles from important foraging habitat or from habitat critical during nesting and internesting periods.	**EPO 1.5; EPO 6.6.**	
	EPO 6 Undertake the Petroleum Activities Program in a manner that will not modify, destroy, fragment, isolate or disturb an important or substantial area of habitat such that an adverse impact on marine ecosystem functioning or integrity results.	**EPO 1.1; EPO 4.1; EPO 6.4; EPO 6.8; EPO 11.5, EPO 12.4; EPO13.4; EPO 15.6; EPO 16.2; EPO 17.2; EPO 18.2.**	

Aspect	EPOs in this EP	Relevant EPOs from the Scarborough OPP	Comparison
Section 6.6.3 Seabed Disturbance (Intervention and Trunkline Installation)	**EPO 3** Undertake the Petroleum Activities Program in a manner that does not result in a substantial change in water quality which may adversely impact on biodiversity, ecological integrity, social amenity or human health.	**EPO 6.1; EPO 7.1 ; EPO 8.1; EPO 9.1; EPO 10.1; EPO12.1; EPO 13.1; EPO 14.1; EPO 15.2.**	The EPOs adopted in the EP for seabed disturbance are consistent with the EPOs in the Scarborough OPP.
	EPO 5 Undertake the Petroleum Activities Program in a manner that aims to avoid the displacement of marine turtles from important foraging habitat or from habitat critical during nesting and internesting periods.	**EPO 1.5; EPO 6.6**	
	EPO 6 Undertake the Petroleum Activities Program in a manner that will not modify, destroy, fragment, isolate or disturb an important or substantial area of habitat such that an adverse impact on marine ecosystem functioning or integrity results.	**EPO 1.1; EPO 4.1; EPO 6.4; EPO 6.8; EPO 11.5, EPO 12.4; EPO13.4; EPO 15.6; EPO 16.2; EPO 17.2; EPO 18.2.**	
	EPO 7 Seabed disturbance from trunkline installation within the Montebello Marine Park will be limited to less than 0.07% of the total park area.	**EPO 6.5**	
	EPO 8 Undertake Scarborough Trunkline Installation within the Montebello AMP in a manner that will be not be inconsistent with the objective of the multiple use zone.	**EPO 6.7**	
	EPO 9 Changes to water quality in the Montebello Marine Park as a result of the trunkline installation will be not be inconsistent with the objective of the multiple use zone.	**EPO 6.3**	
Section 6.6.4 Routine Light Emissions from Project Vessels	**EPO 5** Undertake the Petroleum Activities Program in a manner that aims to avoid the displacement of marine turtles from important foraging habitat or from habitat critical during nesting and internesting periods.	**EPO 1.5; EPO 6.6.**	The EPOs adopted in the EP for routine light emissions are consistent with the EPOs in the Scarborough OPP.

Aspect	EPOs in this EP	Relevant EPOs from the Scarborough OPP	Comparison
	EPO 6 Undertake the Petroleum Activities Program in a manner that will not modify, destroy, fragment, isolate or disturb an important or substantial area of habitat such that an adverse impact on marine ecosystem functioning or integrity results.	**EPO 1.1; EPO 4.1; EPO 6.4; EPO 6.8; EPO 11.5, EPO 12.4; EPO13.4; EPO 15.6; EPO 16.2; EPO 17.2; EPO 18.2.**	
	EPO 10 Undertake the Petroleum Activities Program in a manner that will not have a substantial adverse effect on a population of seabirds or shorebirds, or the spatial distribution of the population.	**EPO 1.2; EPO 15.3**	
	EPO 11 Undertake the Petroleum Activities Program in a manner that will not seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of a migratory species.	**EPO 1.4; EPO 4.3; EPO 10.6; EPO 15.9; EPO 18.5**	
	EPO 12 Undertake the Petroleum Activities Program in a manner that will not substantially modify, destroy or isolate an area of important habitat for a migratory species.	**EPO 1.3; EPO 10.5; EPO 15.8**	
Section 6.6.5 Routine Atmospheric and Greenhouse Gas Emissions	**EPO 13** Undertake the Petroleum Activities Program in a manner that will not result in a substantial change in air quality which may adversely impact on biodiversity, ecological integrity social amenity or human health.	**EPO 2.1.**	**EPO 14 is a new EPO – OPP** EPO 21 relating to Atmospheric and GHG emissions has been updated to be inclusive of all emissions relevant to this PAP.
	EPO 14 Optimise efficiencies in air emissions and reduce GHG emissions to ALARP and acceptable levels	**New EPO**	
Section 6.6.6 Routine Acoustic Emissions	**EPO 6** Undertake the Petroleum Activities Program in a manner that will not modify, destroy, fragment, isolate or disturb an important or substantial area of habitat such that an adverse impact on marine ecosystem functioning or integrity results.	**EPO 1.1; EPO 4.1; EPO 6.4; EPO 6.8; EPO 11.5, EPO 12.4; EPO13.4; EPO 15.6; EPO 16.2; EPO 17.2; EPO 18.2.**	The EPOs adopted in the EP for routine acoustic emissions are consistent with the EPOs in the Scarborough OPP.

Aspect	EPOs in this EP	Relevant EPOs from the Scarborough OPP	Comparison
	EPO 11 Undertake the Petroleum Activities Program in a manner that will not seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of a migratory species.	**EPO 1.4; EPO 4.3; EPO 10.6; EPO 15.9; EPO 18.5.**	
	EPO 15 Undertake the Petroleum Activities Program in a manner that prevents a substantial adverse effect on a population of fish, marine mammals, marine reptiles, or the spatial distribution of a population.	**EPO 4.2; EPO 15.7; EPO 18.4**	
Section 6.6.7 Routine and Non-Routine Discharges: Vessels and Seabed Intervention	**EPO 3** Undertake the Petroleum Activities Program in a manner that does not result in a substantial change in water quality which may adversely impact on biodiversity, ecological integrity, social amenity or human health.	**EPO 6.1; EPO 7.1 ; EPO 8.1 ; EPO 9.1; EPO 10.1; EPO12.1; EPO 13.1; EPO 14.1; EPO 15.2**	The EPO adopted in the EP for project vessel discharges is consistent with the EPOs in the Scarborough OPP.
Section 6.6.8 Routine and Non-Routine Discharges: Trunkline Installation Pre-commissioning	**EPO 3** Undertake the Petroleum Activities Program in a manner that does not result in a substantial change in water quality which may adversely impact on biodiversity, ecological integrity, social amenity or human health.	**EPO 6.1; EPO 7.1 ; EPO 8.1 ; EPO 9.1; EPO 10.1; EPO12.1; EPO 13.1; EPO 14.1; EPO 15.2**	The EPOs adopted in the EP for the Trunkline Pre-commissioning discharges are consistent with the EPOs in the Scarborough OPP.
	EPO 6 Undertake the Petroleum Activities Program in a manner that will not modify, destroy, fragment, isolate or disturb an important or substantial area of habitat such that an adverse impact on marine ecosystem functioning or integrity results.	**EPO 1.1; EPO 4.1; EPO 6.4; EPO 6.8; EPO 11.5, EPO 12.4; EPO13.4; EPO 15.6; EPO 16.2; EPO 17.2; EPO 18.2**	
	EPO 16 Undertake the Petroleum Activities Program in a manner that prevents a substantial adverse effect on a population of plankton including its life cycle and spatial distribution.	**EPO 10.2; EPO 11.3; EPO 12.3; EPO 13.3**	

Aspect	EPOs in this EP	Relevant EPOs from the Scarborough OPP	Comparison
	EPO 17 Undertake the Petroleum Activities Program in a manner which does not modify, destroy, fragment, isolate or disturb an important or substantial area of habitat such that an adverse impact on marine ecosystem functioning or integrity an area defined as a KEF.	**EPO 10.8; EPO 11.6; EPO 12.5; EPO 13.6; EPO 16.3**	
	EPO 18 Undertake the Petroleum Activities Program in a manner that prevents substantial change in sediment quality, that may adversely impact on biodiversity, ecological integrity, social amenity or human health.	**EPO 11.2; EPO 12.2**	
Unplanned Activities			
Section 6.7.2 Unplanned Hydrocarbon Release: Vessel Collision	**EPO 19** No release of hydrocarbons to the marine environment due to a vessel collision associated with the Petroleum Activities Program.	**EPO 19.1**	The EPO adopted in the EP for an unplanned hydrocarbon release from a vessel collision are consistent with the EPOs in the Scarborough OPP.
Section 6.7.3 Unplanned Hydrocarbon Release: Bunkering	**EPO 20** Undertake the Petroleum Activities Program in a manner that will prevent an unplanned release of non-process/reservoir hydrocarbons to the marine environment resulting in a substantial change in water quality which may adversely impact on biodiversity, ecological integrity, social amenity or human health.	**New EPO**	This EPO has been adapted from EPO 14.1 in the Scarborough OPP which pertains to chemical releases; and made relevant to non-process/reservoir hydrocarbons such as vessel marine fuel.
Section 6.7.4 Unplanned Discharge – Deck and Subsea Spills	**EPO 3** Undertake the Petroleum Activities Program in a manner that does not result in a substantial change in water quality which may adversely impact on biodiversity, ecological integrity, social amenity or human health.	**EPO 6.1; EPO 7.1 ; EPO 8.1 ; EPO 9.1; EPO 10.1; EPO12.1; EPO 13.1; EPO 14.1; EPO 15.2:**	The EPO adopted in the EP for an unplanned discharge from deck and subsea spills is consistent with the EPOs in the Scarborough OPP.
Section 6.7.5 Unplanned Discharge: Hazardous and Non – Hazardous Solid Waste / Equipment	**EPO 3** Undertake the Petroleum Activities Program in a manner that does not result in a substantial change in water quality which may adversely impact on biodiversity, ecological integrity, social amenity or human health.	**EPO 6.1; EPO 7.1 ; EPO 8.1 ; EPO 9.1; EPO 10.1; EPO12.1; EPO 13.1; EPO 14.1; EPO 15.2**	The EPOs adopted in the EP for an unplanned discharge of hazardous and non-hazardous solid waste / equipment are

Aspect	EPOs in this EP	Relevant EPOs from the Scarborough OPP	Comparison
	EPO 6 Undertake the Petroleum Activities Program in a manner that will not modify, destroy, fragment, isolate or disturb an important or substantial area of habitat such that an adverse impact on marine ecosystem functioning or integrity results.	**EPO 1.1; EPO 4.1; EPO 6.4; EPO 6.8; EPO 11.5, EPO 12.4; EPO13.4; EPO 15.6; EPO 16.2; EPO 17.2; EPO 18.2**	consistent with the EPOs in the Scarborough OPP.
	EPO 10 Undertake the Petroleum Activities Program in a manner that will not have a substantial adverse effect on a population of seabirds or shorebirds, or the spatial distribution of the population.	**EPO 1.2; EPO 15.3**	
	EPO 11 Undertake the Petroleum Activities Program in a manner that will not seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of a migratory species.	**EPO 1.4; EPO 4.3; EPO 10.6; EPO 15.9; EPO 18.5**	
	EPO 15 Undertake the Petroleum Activities Program in a manner that prevents a substantial adverse effect on a population of fish, marine mammals, marine reptiles, or the spatial distribution of a population.	**EPO 4.2; EPO 15.7; EPO 18.4**	
	EPO 12 Undertake the Petroleum Activities Program in a manner that will not substantially modify, destroy or isolate an area of important habitat for a migratory species.	**EPO 1.3; EPO 10.5; EPO 15.8**	
	EPO 21 Undertake Petroleum Activities Program in a manner that will prevent an unplanned release of solid waste to the marine environment resulting in a significant impact.	**EPO 15.1**	
	EPO 22 Undertake the Petroleum Activities Program in a manner that will prevent a substantial adverse effect on a population of fish, or the spatial distribution of the population.	**EPO 10.4; EPO 15.4**	

Aspect	EPOs in this EP	Relevant EPOs from the Scarborough OPP	Comparison
	EPO 23 Undertake the Petroleum Activities Program in a manner that will prevent a substantial adverse effect on a population of marine mammals or the spatial distribution of the population.	**EPO 10.7; EPO 15.5; EPO 18.3**	
Section 6.7.6 Physical Presence (Unplanned): Seabed Disturbance	**EPO 6** Undertake the Petroleum Activities Program in a manner that will not modify, destroy, fragment, isolate or disturb an important or substantial area of habitat such that an adverse impact on marine ecosystem functioning or integrity results.	**EPO 1.1; EPO 4.1; EPO 6.4; EPO 6.8; EPO 11.5, EPO 12.4; EPO13.4; EPO 15.6; EPO 16.2; EPO 17.2; EPO 18.2**	The EPOs adopted in the EP for unplanned seabed disturbance are consistent with the EPOs in the Scarborough OPP.
	EPO 17 Undertake the Petroleum Activities Program in a manner which does not modify, destroy, fragment, isolate or disturb an important or substantial area of habitat such that an adverse impact on marine ecosystem functioning or integrity an area defined as a KEF.	**EPO 10.8; EPO 11.6; EPO 12.5; EPO 13.6; EPO 16.3**	
	EPO 24 Undertake the Petroleum Activities Program in a manner which prevents unplanned seabed disturbance.	**EPO 16.1**	
Section 6.7.7 Physical Presence (Unplanned): Collision with Marine Fauna	**EPO 6** Undertake the Petroleum Activities Program in a manner that will not modify, destroy, fragment, isolate or disturb an important or substantial area of habitat such that an adverse impact on marine ecosystem functioning or integrity results.	**EPO 1.1; EPO 4.1; EPO 6.4; EPO 6.8; EPO 11.5, EPO 12.4; EPO13.4; EPO 15.6; EPO 16.2; EPO 17.2; EPO 18.2**	The EPOs adopted in the EP for the unplanned collision with marine fauna are consistent with the EPOs in the Scarborough OPP.
	EPO 10 Undertake the Petroleum Activities Program in a manner that will not seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of a migratory species.	**EPO 1.4; EPO 4.3; EPO 10.6; EPO 15.9; EPO 18.5**	
	EPO 15 Undertake the Petroleum Activities Program in a manner that prevents a substantial adverse effect on a population of fish, marine mammals, marine reptiles, or the spatial distribution of a population.	**EPO 4.2; EPO 15.7; EPO 18.4**	

Aspect	EPOs in this EP	Relevant EPOs from the Scarborough OPP	Comparison
	EPO 23 Undertake the Petroleum Activities Program in a manner that will prevent a substantial adverse effect on a population of marine mammals or the spatial distribution of the population.	**EPO 10.7; EPO 15.5; EPO 18.3**	
	EPO 25 Undertake the Petroleum Activities Program in a manner which prevents a vessel strike with protected marine fauna during project activities.	**EPO 18.1**	
Section 6.7.8 Physical Presence (Unplanned): Invasive Marine Species	**EPO 6** Undertake the Petroleum Activities Program in a manner that will not modify, destroy, fragment, isolate or disturb an important or substantial area of habitat such that an adverse impact on marine ecosystem functioning or integrity results.	**EPO 1.1; EPO 4.1; EPO 6.4; EPO 6.8; EPO 11.5, EPO 12.4; EPO13.4; EPO 15.6; EPO 16.2; EPO 17.2; EPO 18.2**	The EPOs adopted in the EP for the unplanned introduction of Invasive Marine Species are consistent with the EPOs in the Scarborough OPP.
	EPO 26 Undertake the Petroleum Activities Program in a manner which prevents a known or potential pest species (IMS) becoming established.	**EPO 17.1, EPO 17.3, EPO 17.4**	

6.4 Presentation

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

Scarborough OPP – Relevant Impact Assessment Section
<Reference to section number in the Scarborough Project OPP>
Context <Description of the context for the impact/risk. Regulation 13(1, 13(2) and 13(3)>

Relevant Activities	**Existing Environment**	**Stakeholder consultation**
Source of Aspect – **Section reference** *Description of the Activity – Regulation 13(1)*	Relevant environment – **Section reference** *Description of the Environment – Regulations 13(2)(3)*	Consultation – **Section reference** *Consultation – Regulation 11A*

Impact/Risk Evaluation Summary

Source of Impact/Risk Regulation 13(1)	***Environmental Value Potentially Impacted*** Regulations 13(2)(3)							***Evaluation***						
	Soil and Groundwater	**Marine Sediment**	**Water Quality**	**Air Quality (inc. odour)**	**Ecosystems / Habitat**	**Species**	**Socio-economic**	**Decision Type**	**Impact/Consequence**	**Likelihood**	**Current Risk Rating**	**ALARP Tools**	**Acceptability**	**Outcome**
Summary of source of risk/impact														

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

Detailed Impact Assessment
Assessment of Potential Impacts
Receptor <u>Impact / risk</u> Assessment of potential impact *Discussion and assessment of the potential impacts to the identified environment value(s). Regulations 13(5)(6).* *Potential impacts to environmental values have been assigned and discussed based on Woodside's Environmental Consequence Definitions for Use in Environmental Risk Assessments (**Figure 2-1**).*
Cumulative Impacts
Description of any cumulative impacts specific to the PAA (cumulative impact assessment of Scarborough project as a whole is covered in the Scarborough OPP)
Summary of Assessment Outcomes

Rece ptor	**Impact**	**Receptor Sensitivity Level**	**Magnitude**	**Impact Significance Level / Risk Consequence**

Overall Impact Significance Level/ Risk consequence: *Roll up to Impact/consequence rating (in impact/risk evaluation summary at top of this table) but need to look at individual receptors as being equal to or less than level of acceptability in the Scarborough OPP.*	***Overall Impact Significance Level/ Risk consequence:*** *Roll up to Impact/consequence rating (in impact/risk evaluation summary at top of this table) but need to look at individual receptors as being equal to or less than level of acceptability in the Scarborough OPP.*

Demonstration of ALARP				
Control Considered	***Control Feasibility (F) and Cost/Sacrifice (CS)***	***Benefit in Impact/Risk Reduction***	***Proportionality***	***Control Adopted***
ALARP Tool Used – Section 2.3.4				
Summary of control considered to ensure the impacts and risks are continuously reduced to ALARP. *Regulation 13(5)(c).*	*Technical/logistical feasibility of the control.* *Cost/sacrifice required to implement the control (qualitative measure).*	*Quantum of impact/risk that could be averted (measured in terms of reduction of likelihood, consequence and current risk rating) if the cost/sacrifice is made and the control is adopted.*	*Proportionality of cost/sacrifice vs environmental benefit. If proportionate (benefits outweigh costs) the control will be adopted. If disproportionate (costs outweigh benefits) the control will not be adopted.*	*If control is adopted: Reference to Control # provided.*
ALARP Statement: *Made on the basis of the environmental risk assessment outcomes, use of the relevant tools appropriate to the decision type (**Section 2.3.3** and **Figure 2-3**) and a proportionality assessment. Regulation 10A(b).*				

Demonstration of Acceptability
Acceptability Criteria and Assessment
Impact Significance Level / Risk Consequence levels for receptors are within acceptable bounds of the Scarborough OPP: ***Adoption of relevant Scarborough OPP EPO's and controls:*** ***Internal/external context and other requirements specific to this EP Petroleum Activities Program***:
Acceptability Statement: *Outcomes of the impact assessment in comparison to Scarborough OPP and ALARP demonstration.*

Environmental Performance Outcomes, Standards and Measurement Criteria			
EPO	***Adopted Control(s)***	***EPS***	***MC***
EPO# S: *Specific performance which addresses the legislative and other controls that manage the activity and against which performance by Woodside in protecting the environment will be measured.* M: *Performance against the outcome will be measured by measuring implementation of*	**C#** *Identified control adopted to ensure the impacts and risks are continuously reduced to ALARP.* ***Regulation 13(5)(c).***	***PS#*** *Statement of the performance required of a control measure. Regulation 13(7)(a)*	***MC#*** *Measurement criteria for determining whether the outcomes and standards have been met. Regulation 13(7)(c)*

the controls via the measurement criteria. A: *Achievability/feasibility of the outcome demonstrated via discussion of feasibility of controls in ALARP demonstration. Controls are directly linked to the outcome.* R: *The outcome will be relevant to the source of risk and the potentially impacted environmental value.* T: *The outcome will state the timeframe during which the outcome will apply or by which it will be achieved.*			

6.5 Potential Environment Risks Not Included Within the Scope of this Environment Plan

The ENVID identified environmental risks that were assessed as not being applicable within or outside the Operational Area as a result of the Petroleum Activities Program and, therefore, were determined to not form part of this EP. These are described in the next sections for information only.

6.5.1 Shallow/Near-shore Activities

The Petroleum Activities Program is located in water depths greater than 30 m and more than 5 km from nearest landfall (Dampier Archipelago). Consequently, risks associated with shallow/ near-shore activities and risks of grounding were assessed as not credible.

6.5.2 Loss of Containment from Existing or Third Party Subsea Infrastructure

As described in **Section 4.9.6**, the Trunkline Project Area intersects several existing oil and gas pipelines (**Table 3-8**) and several facilities are located within 50 km of the Operational Area. A subsea loss of containment from a rupture of the one of these pipelines within the Operational Area could occur in the event of a dropped object, or anchor drag in the case of the shallow water lay barge.

Worst-case credible hydrocarbon release scenarios have been defined in relevant EPs including:

- Start-Up and Operations EP for the Wheatstone Project
- Reindeer Wellhead Platform and Offshore Pipeline Operations EP
- Julimar Operations EP
- Pluto Facility Operations EP

These EPs include subsea loss of containment resulting from a rupture of the pipeline/flowline where relevant. The existing EPs provide a description and assessment of impacts and risks as well as management controls and response capabilities for a pipeline/flowline rupture.

Commercial and technical agreements covering PAP crossing design and construction are being developed with the relevant third parties, and third party asset representatives are involved in the Woodside process safety framework. The representatives help to identify risks and controls relevant for the PAP, and change manage existing asset risk profiles accordingly.

While it is credible for activities within the PAP to cause damage to third party infrastructure, at the point of environmental consequence occurring the event falls in the scope of the relevant third party Environment Plan described above. Additional controls for operating the project vessels are provided throughout **Sections 6.6** and **6.7** of this EP. In particular, controls are included for the prevention of dropped objects (**Section 6.7.6**).

Table 6-2: Environmental Risk analysis and summary

Aspect	EP Section	Risk Rating				Acceptability
		Impact/Consequence	Potential Impact/Consequence Level	Likelihood	Current Risk Rating	
Planned Activities (Routine and Non-routine)						
Physical Presence – Interaction with other marine users	**6.6.1**	E	Environment – Slight, short-term impact (less than one year) on species, habitat (but not affecting ecosystems function), physical or biological attributes.	-	-	Broadly Acceptable Has been shown to meet requirements listed in **Section 2.3.5**
Physical Presence – Seabed Disturbance (Dredging, Spoil Disposal and Backfill)	**6.6.2**	D	Environment – Minor, short-term impact (1–2 years) on species, habitat (but not affecting ecosystem function), physical or biological attribute.	-	-	Broadly Acceptable Has been shown to meet requirements listed in **Section 2.3.5**
Physical Presence – Seabed Disturbance (Intervention and Trunkline Installation)	**6.6.3**	D	Environment – Minor, short-term impact (1–2 years) on species, habitat (but not affecting ecosystem function), physical or biological attribute.	-	-	Broadly Acceptable Has been shown to meet requirements listed in **Section 2.3.5**
Routine Light Emissions from Project Vessels	**6.6.4**	E	Environment – Slight, short-term impact (less than one year) on species, habitat (but not affecting ecosystems function), physical or biological attributes.	-	-	Broadly Acceptable Has been shown to meet requirements listed in **Section 2.3.5**
Routine Atmospheric and Greenhouse Gas Emissions	**6.6.5**	F	Environment – No lasting effect (less than one month); localised impact not significant to environmental receptors.	-	-	Broadly Acceptable Has been shown to meet requirements listed in **Section 2.3.5**

Aspect	EP Section	Risk Rating				Acceptability
		Impact/Consequence	**Potential Impact/Consequence Level**	**Likelihood**	**Current Risk Rating**	
Routine Acoustic Emissions	**6.6.6**	E	Environment – Slight, short-term impact (less than one year) on species, habitat (but not affecting ecosystems function), physical or biological attributes.	-	-	Broadly Acceptable Has been shown to meet requirements listed in **Section 2.3.5**
Routine and Non-Routine Discharges: Vessels and Seabed Intervention	**6.6.7**	E	Environment – Slight, short-term impact (less than one year) on species, habitat (but not affecting ecosystems function), physical or biological attributes.	-	-	Broadly Acceptable Has been shown to meet requirements listed in **Section 2.3.5**
Routine and Non-Routine Discharges – Trunkline installation and Pre-commissioning	**6.7.8**	E	Environment – Slight, short-term impact (less than one year) on species, habitat (but not affecting ecosystems function), physical or biological attributes.	-	-	Broadly Acceptable Has been shown to meet requirements listed in **Section 2.3.5**
Unplanned Activities (Accidents, Incidents, Emergency Situations)						
Unplanned Hydrocarbon Release: Vessel Collision	**6.7.2**	B	Environment –. Major, long-term impact (10-50 years) on highly valued ecosystems, species, habitat or physical or biological attributes	1	M	Acceptable if ALARP Has been shown to meet requirements listed in **Section 2.3.5**
Unplanned Hydrocarbon Release: Bunkering	**6.7.3**	F	Environment – No lasting effect (less than one month); localised impact not significant to environmental receptors.	2	L	Broadly Acceptable Has been shown to meet requirements listed in **Section 2.3.5**
Unplanned Hydrocarbon Release: Deck and Subsea Spills	**6.7.4**	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 Has been shown to meet requirements listed in **Section 2.3.5**

Aspect	EP Section	Risk Rating				Acceptability
		Impact/Consequence	Potential Impact/Consequence Level	Likelihood	Current Risk Rating	
Unplanned Discharge: Hazardous and Non – Hazardous Solid Waste	**6.7.5**	D	Environment – No lasting effect (less than one month); localised impact not significant to environmental receptors.	0	L	Broadly Acceptable Has been shown to meet requirements listed in **Section 2.3.5**
Physical Presence (Unplanned): Seabed Disturbance	**6.7.6**	D	Environment – Minor, short-term impact (1–2 years) on species, habitat (but not affecting ecosystem function), physical or biological attribute.	2	M	Broadly Acceptable Has been shown to meet requirements listed in **Section 2.3.5**
Physical Presence (Unplanned): Interaction with Marine Fauna	**6.7.7**	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 Has been shown to meet requirements listed in **Section 2.3.5**
Physical Presence (Unplanned): Accidental Introduction and Establishment of Invasive Marine Species	**6.7.8**	D	Minor, short-term impact (1–2 years) on species, habitat (but not affecting ecosystem function), physical or biological attribute.	0	L	Broadly Acceptable Has been shown to meet requirements listed in **Section 2.3.5**

6.6 Planned Activities (Routine and Non-Routine)

6.6.1 Physical Presence – Interactions with Other Marine Users

Scarborough OPP – Relevant Impact Assessment Section		
Section 7.1.5 – Displacement of Other Users		
Context		
Relevant Activities Vessel Operations – **Section 3.7** Support Operations – **Section 3.8** Seabed Intervention Activities – **Section 3.9** Trunkline Installation Activities – **Section 3.11**	**Existing Environment** Socio-economic values – **Section 4.9**	**Stakeholder consultation** Consultation – **Section 5**

Impact/Risk Evaluation Summary														
Source of Impact/Risk	***Environmental Value Potentially Impacted***							***Evaluation***						
	Soil and Groundwater	**Marine Sediment**	**Water Quality**	**Air Quality (inc. odour)**	**Ecosystems / Habitat**	**Species**	**Socio-economic**	**Decision Type**	**Impact/Consequence**	**Likelihood**	**Current Risk Rating**	**ALARP Tools**	**Acceptability**	**Outcome**
Interaction with other marine users –project vessels, ROV and helicopters interfering with or displacing third party vessels and/or aircraft (commercial fishing and commercial shipping, defence)							✓	A	E	-	-	LCS GP PJ	Broadly Acceptable	EPO 1 and 2

Description of Source of Impact/Risk
Vessel Operations Several vessel types will be required to complete the activities associated with the Petroleum Activities Program (refer to **Section 3.9.2**). Vessels will not usually anchor within the Operational Area during activities and instead maintain positioning using DP. The physical presence and movement of project vessels within the Operational Area has the potential to displace other marine users. Vessel physical presence and movement closer to the Dampier Archipelago and the Pilbara Port Authority Management Area is limited to activities along the trunkline route, the cycling of dredging and backfill between the Offshore Borrow Ground Project Area and Trunkline Project Area, and disposal of material in Spoil Ground 5A. These activities will be conducted over a period of months (refer to **Section 3.6**), and vessels will be continually moving. PV will move at a rate of around 3km per day. Further, all vessels will display navigational lighting and external lighting on a 24-hour basis, as required for safe operations. The Petroleum Activities Program may not be executed as a single campaign or in a consecutive sequence, therefore the presence of vessels may occur at any time during the five-year period of the EP. Temporary exclusion zones will be established around operating vessels. These will be confirmed during Safety Case development and notifications to mariners will be issued at the time of the activity.

Exclusion zone around SWLB within anchor pattern

The SWLB may be required to operate in Commonwealth waters, up to around KP 33, as it finishes laying the nearshore section of the Trunkline. The SWLB will be positioned using anchors and movement to lay the trunkline will be achieved by moving the anchors via the AHTs. Other third party vessels will be excluded from the moorings and anchor pattern for safety purposes. There is the potential for the SWLB anchor pattern exclusion zone to temporarily displace third party vessels. SWLB will implement an exclusion zone covering the mooring spread (nominally 1600 m) - this will be confirmed during Safety Case development and will be communicated to stakeholders during start of activity notifications.

Helicopter Operations

Helicopters will be used to transport personnel during the Petroleum Activities Program. Transport will occur on a regular basis, potentially with multiple flights per day (for larger vessels such as the PV) up to six days a week.

Detailed Impact Assessment

Assessment of Potential Impacts

Commonwealth and State-managed Fisheries

Five Commonwealth-managed fisheries and fourteen State-managed fisheries overlap with the Operational Area (refer to **Section 4.9.2**). Potential impacts to commercial fishers depends on the use of the area by fishers, and the temporal and spatial extent of the presence of vessels. Potential impacts to commercial fisheries include loss of commercial catch due to displacement from fishing grounds.

During the Petroleum Activities Program the presence of vessels will present a surface hazard to fishing vessels. Given the distance offshore, the majority of the Operational Area does not represent an area of high commercial fishing activity, however fishing activity is higher in nearshore waters, including KP 32 to KP 50. Activities in nearshore waters will take place over a short period, with pre-lay trenching and spoil disposal expected to take approximately two months and pipelay approximately six months along the full trunkline route (refer to **Table 3-4**). During this period, vessels will be continually moving and operating within a small spatial footprint. The presence of vessels and exclusion zones around the anchor spread for the SWLB (if required) will be limited to specific areas of the Operational Area at any one time. Therefore, fishing vessels will not be excluded from the entire Operational Area for the total duration of the Petroleum Activities Program. Furthermore, the Operational Area comprises a relatively small area when compared to the extent of the individual fishery boundaries. As such, displacement of commercial fisheries due to activities in the Operational Area are not expected to impact commercial fishing activities or the economic viability of the fisheries.

Considering the temporary and localised displacement potential for commercial fisheries due to the Petroleum Activities Program in the Operational Area, significant impacts to fishing activities are not expected. Any displacement of fishing activities will be temporary and have no lasting effect.

Tourism and Recreation

Tourism and recreation within the Operational Area is expected to be limited by the distance offshore and water depth. Some tourism may occur in the nearshore waters of the Trunkline Project Area, particularly in proximity to the Montebello Islands (refer to **Section 4.9.4**). However, impacts are expected to be limited by the short duration of the Petroleum Activities Program at this location, and the distance from these islands. Stakeholder consultation did not identify any key recreational fishing activity within the Operational Area. Potential impacts to tourism and recreational activities would likely be a minor interference (i.e. navigational hazard) and temporary, localised displacement/avoidance.

Shipping

Impact to commercial shipping is limited to the temporary presence of vessels throughout the Petroleum Activities Program. It is noted that a number of AMSA marine fairways intersect with the Operational Area (refer to **Section 4.9.5**). Dredging, material disposal and backfill activities, particularly in the shallower waters (KP 32 to KP 50 of the Operational Area) closer to the Dampier Archipelago and Pilbara Port Authority Management Area may cause temporary disruption to commercial shipping vessels. Interactions can be managed using well established maritime practices and, therefore, project activities are not expected to significantly disrupt shipping movements or port operations. Potential impacts to commercial shipping vessels are expected to include short-term displacement of vessels as they make slight course alterations to avoid the project vessels, which may result in minor delays or increased fuel use due to them having to take a less direct route. The presence of vessels and exclusion zones around them, including around the anchor spread for the SWLB (if required), will be limited to specific areas of the Operational Area at any one time, therefore resulting in a minor interference (i.e., navigational hazard) and localised displacement/avoidance by shipping.

Industry

A number of oil and gas facilities are located in proximity to the Operational Area, including a number of existing pipelines and fibre optic cables which intersect the Trunkline Project Area, requiring installation crossing supports (refer to **Section 3.9.6**). Rock berms and mattresses installed over existing infrastructure will be placed in a controlled manner, with positioning guidance from an ROV. The trunkline touchdown point will be continually monitored during installation over third party asset crossings to ensure correct instalment and no damage to infrastructure. Activities associated with the physical presence of vessels may result in localised, short-term interference to industry vessels requiring minor course alteration or readjustment in asset management while the PAP is active in the area. However, impacts are not expected to have lasting effect.

Defence

Defence activities in the vicinity of the Operational Area may include Naval vessel traffic and Air Force training exercises associated with the Learmonth Air Force Base (refer to **Section 4.9.7**). The Trunkline passes through a defence live firing range which is a Restricted Fly Zone. However, these activities are not expected to be a consistent presence in the area. Defence stakeholders were notified and feedback addressed as per **Section 5**. Any potential interaction is expected to be minimal and not significantly different from interaction with other facilities within the northwest region.

Summary of Assessment Outcomes

Receptor	Impact	Receptor Sensitivity Level	Magnitude	Impact Significance Level
Commonwealth-managed Fisheries	Changes to the function interests or activities of others	High value marine user	No Lasting Effect	Slight (E)
State-managed fisheries		High value marine user	No Lasting Effect	Slight (E)
Tourism and Recreation		High value marine user	No Lasting Effect	Slight (E)
Commercial shipping		High value marine user	No Lasting Effect	Slight (E)
Industry		Medium value marine user	No Lasting Effect	Slight (E)
Defence		High value marine user	No Lasting Effect	Slight (E)

Overall Impact Significance Level: The overall impact significance level for interaction with other marine users is E based on no lasting effect to the high value receptors. The impact significance levels for individual receptors are consistent with the levels rated in the OPP, nothing that defence, tourism and recreation were not identified receptors for this risk in the Scarborough OPP.

Demonstration of ALARP

Control Considered	*Control Feasibility (F) and Cost/Sacrifice (CS)*	*Benefit in Impact/Risk Reduction*	*Proportionality*	*Control Adopted*
Legislation, Codes and Standards				
Vessels to adhere to the navigation safety requirements including the *Navigation Act 2012* and any subsequent Marine Orders.	F: Yes. CS: Minimal cost. Standard practice.	The act regulates ship related activities and invokes certain requirements of MARPOL. Vessels (relevant to class) will adhere to requirements.	Benefits outweigh cost/sacrifice. Control is also Standard Practice	Yes **C 1.1**
Establishment of temporary exclusion zones around vessels which are communicated to marine users.	F: Yes. CS: Minimal cost. Standard practice.	Establishment of exclusion zones around the vessels reduces the likelihood of interaction with other marine users.	Benefits outweigh cost/sacrifice. Control is also Standard Practice	Yes **C 1.2**
Good Practice				
Notify Australian Hydrographic Service (AHS) of activities and movements no less than four working weeks prior to scheduled	F: Yes. CS: Minimal cost. Standard practice.	Notification of AHS will enable them to update maritime charts thereby reducing the	Benefits outweigh cost/sacrifice. Control is also Standard Practice.	Yes **C 1.3**

Demonstration of ALARP				
Control Considered	***Control Feasibility (F) and Cost/Sacrifice (CS)***	***Benefit in Impact/Risk Reduction***	***Proportionality***	***Control Adopted***
activity commencement date.		likelihood of interaction with other marine users.		
Notify DPIRD (Western Australia) of activities within three months of seabed intervention and/or trunkline installation.	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 interference with other marine users.	Benefits outweigh cost/sacrifice. Control is also Standard Practice.	Yes **C 1.4**
Notify AMSA Joint Rescue Coordination Centre (JRCC) of activities and movements 24 to 48 hours before operations commence.	F: Yes. CS: Minimal cost. Standard practice.	Communication of the Petroleum Activities Program to other marine users ensures they are informed and aware, thereby reducing the likelihood of interference with other marine users.	Benefits outweigh cost/sacrifice. Control is also Standard Practice.	Yes **C 1.5**
Professional Judgement - Eliminate				
Limit activities to avoid peak shipping and commercial fishing activities.	F: No. Shipping occurs year-round and cannot be avoided. SIMOPS with fishing seasons cannot be eliminated as exact timings for all activities are not confirmed. CS: Not considered – control not feasible	Not considered – control not feasible.	Not considered – control not feasible.	No
Professional Judgement - Substitute				
No additional controls identified.				
Professional Judgement – Engineered Solutions				
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 2.3.3**), Woodside considers the adopted controls appropriate to manage the impacts of the physical presence of the Petroleum Activities Program on other users. 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 Criteria and Assessment
The Petroleum Activities Program meets the acceptability criteria (**Section 2.3.5**): • Overall impact significance levels for individual receptors are consistent with the levels rated in the OPP.

- EPOs and controls in the Scarborough OPP that are relevant to the interaction with other users have been adopted.
- There are no changes to internal/external context specific to this risk from the Scarborough OPP, including issues raised during stakeholder consultation.

Acceptability Statement:

The impact assessment has determined that, given the adopted controls, the Petroleum Activities Program is unlikely to result in an impact significance level greater than Slight.

The adopted controls are considered consistent with industry good practice and professional judgement and meet the requirements and expectations of Australian Marine Orders, AMSA, DPIRD, and AHS identified during impact assessment and stakeholder consultation. Further opportunities to reduce the impacts have been investigated above.

The potential impacts are considered broadly acceptable if the adopted controls are implemented. Therefore, Woodside considers the adopted controls appropriate to manage the impacts from the physical presence of the Petroleum Activities Program to a level that is broadly acceptable.

Environmental Performance Outcomes, Standards and Measurement Criteria

EPO	*Adopted Control(s)*	*EPS*	*MC*
EPO 1 Undertake the Petroleum Activities Program in a manner that will not have a substantial adverse effect on the sustainability of commercial fishing. **EPO 2** Undertake the Petroleum Activities Program in a manner that does not interfere with other marine users to a greater extent than is necessary for the exercise of right conferred by the titles granted.	**C 1.1** Vessels to adhere to the navigation safety requirements including the *Navigation Act 2012* and any subsequent Marine Orders.	**PS 1.1** Vessels compliant with Navigation Act and Marine Order 21 (Safety of navigation and emergency procedures) 2012	**MC 1.1.1** Marine assurance inspection records demonstrate compliance with standard maritime safety procedures
	C 1.2 Establishment of temporary exclusion zones around vessels which are communicated to marine users.	**PS 1.2** No entry of unauthorised vessels within exclusion zones.	**MC 1.2.1** Records of breaches by unauthorised vessels within exclusion zones.
			MC 1.2.2 Notice to Mariners (NTM) (including AUSCOAST warnings where relevant) generated to communicate exclusion zones to marine users.
	C 1.3 Notify AHS of activities and movements no less than four working weeks prior to the scheduled activity commencement date.	**PS 1.3** Notification to AHS of activities and movements to allow generation of navigation warnings (Maritime Safety Information Notifications (MSIN) and Notice to Mariners (NTM) (including AUSCOAST warnings where relevant)).	**MC 1.3.1** Consultation records demonstrate that AHS has been notified prior to commencement of an activity
	C 1.4 Notify DPIRD (Western Australia) of activities within three months of seabed intervention and/or trunkline installation.	**PS 1.4** DPIRD notified in order to inform other marine users of the activities to reduce activities interfering with other marine users for longer than necessary.	**MC 1.4.1** Consultation records demonstrate that DPIRD have been notified prior to commencement of the activity.
	C 1.5 Notify AMSA JRCC of activities and movements	**PS 1.5** AMSA JRCC notified 24 to 48 hours before operations	**MC 1.5.1** Consultation records demonstrate that AMSA

Environmental Performance Outcomes, Standards and Measurement Criteria			
EPO	***Adopted Control(s)***	***EPS***	***MC***
	24 to 48 hours before operations commence. AMSA's JRCC will require the vessel's details (including name, callsign and Maritime Mobile Service Identity (MMSI)), satellite communications details (including INMARSAT-C and satellite telephone), area of operation, requested clearance from other vessels and need to be advised when operations start and end.	commence to prevent activities interfering with other marine users.	JRCC has been notified prior to commencement of the activity within required timeframes.

6.6.2 Physical Presence – Seabed Disturbance (trenching, spoil disposal, borrow ground dredging and Trunkline backfill)

Scarborough OPP – Relevant Impact Assessment Section		
Section 7.1.6 – Seabed Disturbance		
Context		
Relevant Activities Seabed Intervention Activities – **Section 3.9** Trunkline Installation Activities – **Section 3.11** Contingent Activities – **Section 3.12**	**Existing Environment** Marine Regional Characteristics – **Section 4.2** Physical Environment – **Section 4.4** Habitats and Biological Communities – **Section 4.5**	**Stakeholder consultation** Consultation – **Section 5**

Impact/Risk Evaluation Summary

Source of Impact/Risk	*Environmental Value Potentially Impacted*							*Evaluation*						
	Soil and Groundwater	**Marine Sediment**	**Water Quality**	**Air Quality (inc. odour)**	**Ecosystems / Habitat**	**Species**	**Socio-economic**	**Decision Type**	**Impact/Consequence**	**Likelihood**	**Current Risk Rating**	**ALARP Tools**	**Acceptability**	**Outcome**
Trunkline trenching (and material disposal)		✓	✓		✓			A	D	-	-	LCS GP PJ	Broadly Acceptable	EPO 3,4,5,6
Offshore borrow ground dredging		✓	✓		✓			A	D	-	-			
Trunkline backfill activities		✓	✓		✓			A	D	-	-			

Description of Source of Impact/Risk

This section assesses potential impacts from seabed disturbance resulting from Trunkline trenching and spoil disposal, offshore borrow ground dredging and Trunkline backfill activities. Seabed disturbance from trunkline installation and general seabed intervention activities are assessed in **Section 6.6.3**.

Trunkline trenching and spoil disposal

It is anticipated that trunkline stabilisation and hence trenching and backfill activities will be required in water depths shallower than 40 m, which corresponds to a location about 50 km offshore. Trunkline trenching activities will occur within the Trunkline Project Area (**Section 3.9.3**) and may result in seabed disturbance between the State Waters boundary (approximately KP 32) to a maximum of KP50 (including Spoil Ground 5A). The distance that trenching is required to extend into Commonwealth waters is being further refined during detailed engineering, so actual trenching and backfill activities may cover a smaller area.

Pre-lay trenching works involves dredging a trench about 2 to 3.5 m deep within the indicative trunkline disturbance corridor (~30 m width). A seabed disturbance area of about 0.54 km^2 is expected.

Trenched material from Commonwealth waters may be disposed into existing Spoil Ground 5A, which lies within the Trunkline Project Area and is approximately 300 m wide and runs for about 18 km between the State waters boundary and KP 50. A total volume of around 0.8 Mm^3 of trenched material may be disposed of within Spoil Ground 5A.

Through the placement of sediment within Spoil Ground 5A, it is expected an area of around 1.6 km^2 of seabed disturbance may occur (with maximum allowable disturbance area of 5.1 km^2 based on the entire spoil ground being disturbed, which is not anticipated). Note Spoil Ground 5A has been used previously. In this activity, sediment will be released from the hopper doors on the bottom of the TSHD where it will rapidly descend and deposit on the seabed within the designated disposal area.

Offshore borrow ground dredging and Trunkline backfill

After the installation of the trunkline in the trench, backfilling with dredged material from the Offshore Borrow Ground will be required to help stabilise the trunkline. Approximately 2 Mm^3 of backfill material will be sourced from the Offshore Borrow Ground, within Commonwealth waters. (**Section 3.9.4**). Approximately 0.9 Mm^3 (in the case of backfill from KP 32 to KP 50) of sandy sediments with a low proportion of fines will be required to help stabilise the trunkline in Commonwealth waters, with the remainder potentially being used in State waters for the same purpose. Backfill material will be dredged and placed using a TSHD.

When backfilling the trunkline some trench overflow may occur due to the natural angle of repose of the material, as well as influencing hydrodynamic factors such as currents. The indicative width of seabed disturbance within the Trunkline Project Area is 30 m (i.e., the trunkline disturbance corridor), however for sand backfilling it is expected sediments will settle further afield due to hydrographic conditions in some locations.

Dredging within the offshore borrow ground is expected to result in a seabed disturbance area of around 4 km^2 (with maximum allowable disturbance area of 17 km^2 based on the entire borrow ground being disturbed, which is not anticipated). To avoid accidental incursion of seabed disturbance into the Dampier AMP, which lies adjacent to the proposed Offshore Borrow Ground, a 250 m buffer zone will be applied.

Contingency Activities

Secondary dredging of the pre-lay trench via the TSHD may be required if the trench silts up prior to pipelay (**Section 3.12.10**). Any additional material removed from the trench would be placed in Spoil Ground 5A as described above.

Seabed Disturbance Summary

Table 6-3 provides details on the expected and maximum total seabed disturbance from trenching and spoil disposal and borrow ground dredging and backfill activities. All disturbance will occur within the disturbance footprint as detailed within Section 7.1.6.1 of the Scarborough OPP (SA0006AF0000002, Rev 5).

Table 6-3: Dredging (trenching and borrow ground), spoil disposal and backfill seabed disturbance summary

Activity	Description	Expected disturbance area (*km^2*)	Maximum allowable disturbance area (*km^2*)
Trunkline trenching, spoil disposal and backfill	Trunkline trenching and backfill[1]	0.24	0.54
	Spoil Ground 5A material disposal[2]	1.6	5.1
Offshore borrow ground dredging	Dredging within offshore borrow ground to source material for backfill	4	17

Note 1: Expected disturbance assumes KP32 to KP40, although impact assessment and maximum extent is to KP50

Note 2: Disturbance located within previously disturbed ground

Detailed Impact Assessment

Assessment of Potential Impacts

Seabed disturbance has the potential to result in the following impact(s):

- a change in habitat
- a change in water and sediment quality

Which may have the following further impacts

- injury and/or mortality to fauna

These are described in full in Section 7.1.6 of the Scarborough OPP (SA0006AF0000002, Rev 5), with no additional impacts identified for this EP. Where activities are consistent with those described in the Scarborough OPP, this section provides a summary of the assessment outcomes in the context of the Petroleum Activities Program covered by this EP. Where additional definition in relation to risks and impacts are available, this section provides additional detail as part of the impact assessment.

Sediment dispersion modelling was undertaken (RPS, 2020) to assess the potential impacts to water quality and benthic communities from trenching and spoil disposal, and borrow ground dredging and backfill activities occurring in Commonwealth waters as part of the overall Scarborough project (which includes State and Commonwealth waters activities). Sediment dispersion modelling has been revised since the acceptance of the Scarborough OPP (RPS 2020) to account for further Project definition realised during front end engineering and design, including additional geotechnical results. The revised modelling also provided an opportunity to further refine the source term assumptions and approach with the modelling consultant, RPS, to incorporate further learning from the WAMSI dredging science node, where applicable. To support the revised modelling a two stage peer review was completed, with Stage 1 being a review of the appropriateness of the model inputs and process for the revised Scarborough dredge dispersion modelling study, and Stage 2 a review of the outcomes of the modelling and in particular whether the interpretation and conclusions were appropriate, with due consideration to dredging science and guidance.

A Zone of Influence (ZoI) was determined from the sediment dispersion modelling and is defined as:

'*The area within which changes in water quality associated with dredge plumes are predicted and anticipated during the dredging operations, but where these changes would not result in a detectable impact on benthic biota. These areas can be large, but at any point in time the dredge plumes are likely to be restricted to a relatively small portion of the Zone of Influence. The outer boundary of the Zone of Influence bounds the composite of all of the predicted maximum extents of dredge plumes and represents the point beyond which dredge-generated plumes should not be discernible from background conditions at any stage during the dredging campaign'*.

As detailed in **Section 4.1**, the ZoI contributes to the extent of the EMBA for this EP.

Results of the modelling are summarised below.

Sediment Dispersion Modelling Summary

Three-dimensional numerical modelling was used to simulate the distribution of sediments suspended by the trenching and spoil disposal, and borrow ground dredging and backfill activities for the entire campaign (covering both State and Commonwealth activities) (RPS 2020). Model outputs were interrogated using a series of water quality thresholds to predict the extent of potential impacts in a three management zones as recommended by *Technical Guidance Environmental Impact Assessment of Marine Dredging Proposals* (EPA 2021):

- Zone of Influence (ZoI)
- Zone of Moderate Impact (ZoMI)
- Zone of High Impact (ZoHI).

The water quality thresholds applied to determine the three management zones were seasonally dependent, with lower thresholds applied in winter to account for lower background turbidity compared to summer (based on baseline data). It should be noted that the indicated management zone extents in each case represent a cumulative measure of exceedances of thresholds over the relevant duration of activities. They do not represent an instantaneous plume footprint at any one point in time. Note, conservatively, modelling did not include the 250 m buffer zone between the borrow ground and Dampier AMP.

Dredging of the trench and spoil disposal activities to be undertaken in Commonwealth waters (**Figure 6-1**) are predicted by the modelling to cause detectable changes in water quality from elevated suspended sediment concentrations (as represented by the ZoI), however these increases in suspended sediment are predicted to remain below the intensity-duration thresholds that may cause an impact to benthic biota (as represented by the lack of ZoMI in Commonwealth waters). This is based on the conservative application of coral thresholds in State waters (including Madeleine Shoals, north of Legendre Island) and sponge thresholds in the offshore zone (i.e., Dampier AMP), as the most sensitive receptors in each zone.

For Offshore Borrow Ground dredging and backfill activities (**Figure 6-2**) the majority of the sediment suspended by dredging is forecast to be dispersed in the offshore area between the borrow ground and Legendre Island, including incursion into the Dampier AMP. Detectable changes in water quality, as represented by the ZoI, are predicted to extend into the Habitat Protection Zone (IV) of the Dampier AMP, but are not forecasted to intersect with the National Park Zone (II). Elevated suspended sediments are predicted to remain below the intensity-duration thresholds that may cause an impact to benthic biota (as represented by the lack of ZoMI).

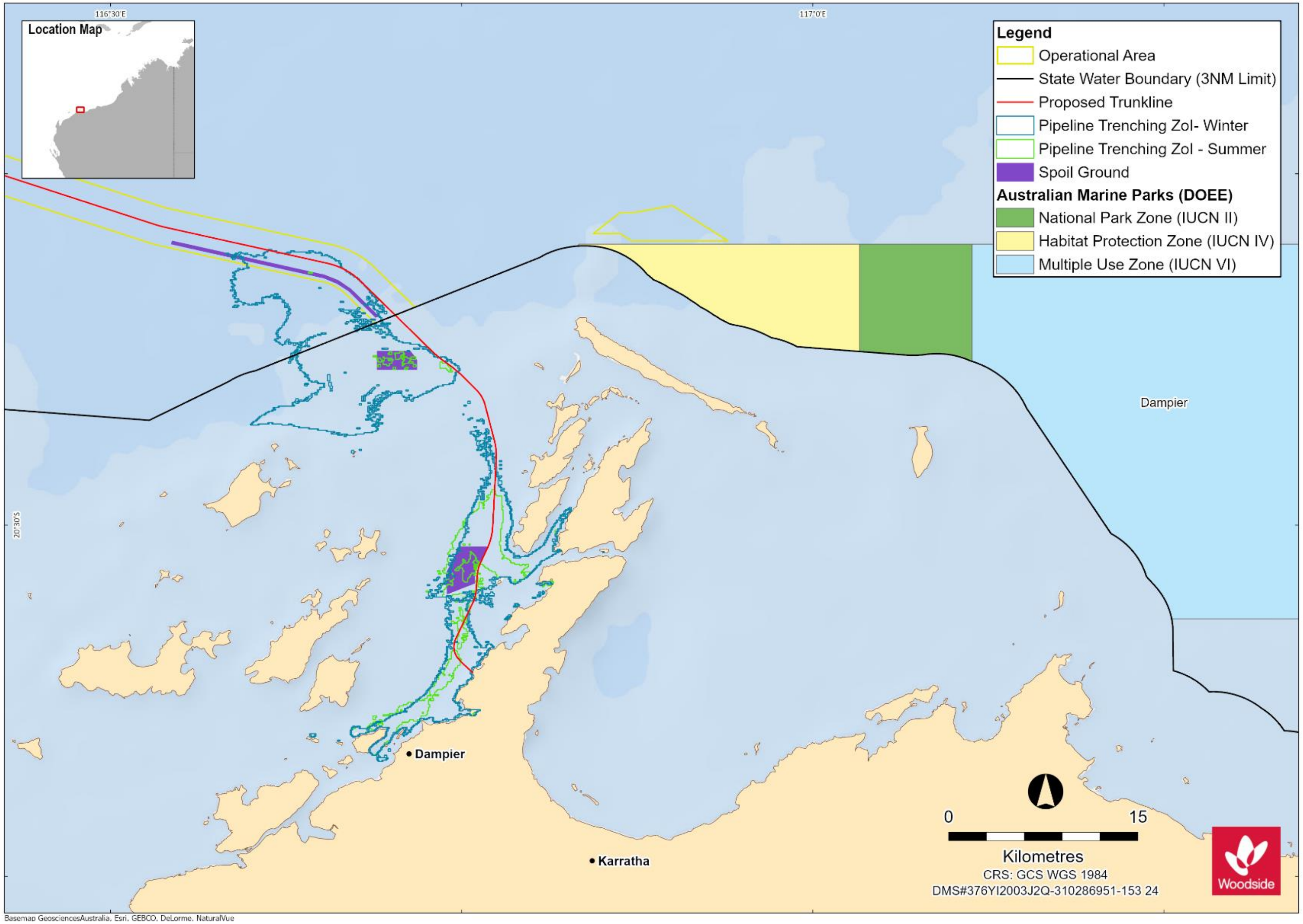


Figure 6-1: Predicted ZoI for pipeline trenching and spoil disposal in Commonwealth and State waters (based on 24-hour rolling average)

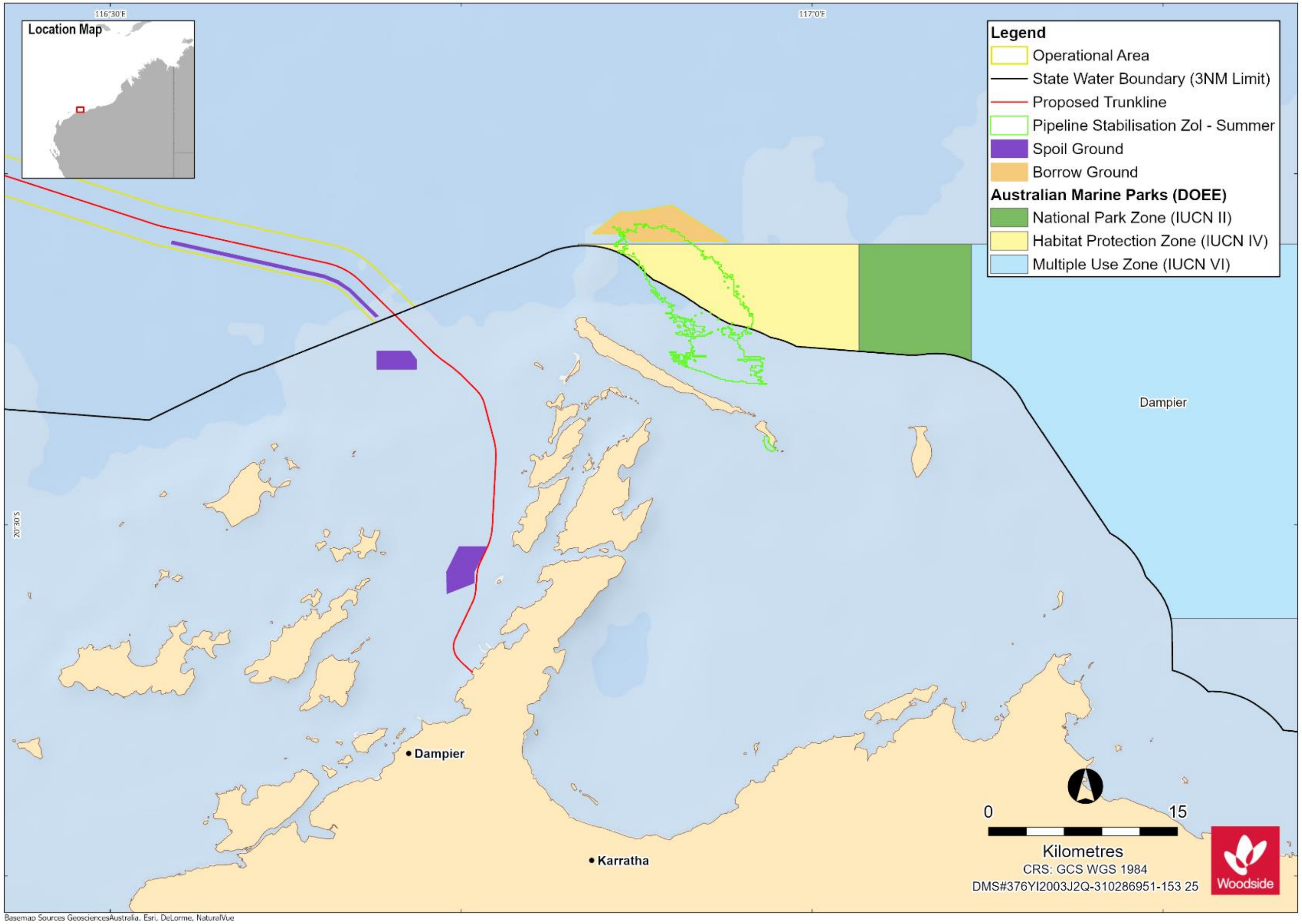


Figure 6-2: Predicted ZoI for pipeline stabilisation activities with backfill material sourced from Offshore Borrow Ground (based on 24-hour rolling average)

Water and Sediment Quality

Water quality change occurs when seabed sediments enter the water column (turbidity). Turbidity may occur during any activity which requires contact with, or occurs in close proximity to, the seabed. After a period, the suspended sediments settle and the turbidity in the water column returns to pre-disturbance levels. Impacts to sediment quality may occur from the redistribution of sediments, including changes to particle size distribution.

Potential impacts associated with changes in water quality is influenced by the local environment (sediment particle size distribution, natural turbidity) and nature of the activity, as described below:

- Elevated suspended sediment concentrations in the water column due to dredging, spoil disposal and backfill activities are expected to be spatially and temporally confined due to progression of the activities along the trunkline route. During trenching and borrow ground dredging by the trailing suction hopper dredge (TSHD), the primary plume at the draghead and from overflow is expected to settle within days, with the majority of particles suspended during the activity settling directly to the seabed, with some finer particle settling further afield. Monitoring results from the Pluto LNG Foundation project indicated a rapid decrease in turbidity beyond the immediate dredging footprint, with the median turbidity measured in proximity to the dredge rapidly dropping below the median and 80th percentile of natural turbidity at two reference sites located in areas unaffected by dredging (MScience, 2018).
- Similarly, spoil disposal activities within Commonwealth waters are expected to result in short term elevations during disposal, progressing along Spoil Ground 5A, parallel to the trunkline route. During disposal of trenched material from the TSHD, sediment would be released into the upper part of the water column, from where it would rapidly descend as a density current, with the heavy particles tending to entrain lighter particles, followed by a billowing of lighter components back into the water column after contact with the seabed. It is expected that these particles would likely settle back to seabed within hours/days, with some finer particles settling further afield.
- Peaks in suspended sediment associated with borrow ground dredging are expected to be of short duration given the intermittent nature of the activity, whereby the dredge fills the hopper (typically using overflow), sails to the trunkline section and places backfill material. Backfill operations involve the placement of coarser materials for trunkline stabilisation, and the fines component is therefore expected to be less than the dredging of the seabed. Given the lower fines component, suspended sediments are expected to settle more rapidly, limiting the temporal and spatial scale of any elevated turbidity.
- Note that the overflow funnel(s) of the TSHD will be fitted with “green valves". These valves restrict the entrainment of air into the overflow mixture thereby minimising fines dispersal and associated turbidity. Additionally, the overflow material sinks more rapidly due to density effects allowing better settlement of overflow material (refer to Demonstration of ALARP below).
- Water quality changes as a result of trenching, spoil disposal (within Spoil Ground 5A), borrow ground dredging and associated backfill activities in Commonwealth waters have been examined through sediment modelling (as summarised above), which reported:
    - Detectable changes in water quality (as represented by the ZoI) from trenching and spoil disposal in Commonwealth waters is predicted to remain within the vicinity of the activity, with some minor incursion into State waters (**Figure 6-1**). These increases in suspended sediment concentrations are not predicted to exceed thresholds that may cause an impact to benthic biota (as represented by the lack of ZoMI) in Commonwealth waters.
    - For offshore borrow ground dredging and backfill activities the majority of the sediment suspended by dredging is forecasted by the modelling to be dispersed in the offshore area between the borrow ground and Legendre Island in both seasons (**Figure 6-2**). Detectable changes in water quality, as represented by the ZoI, are predicted to extend into the Habitat Protection Zone (IV) of the Dampier AMP, but not the National Park Zone (II).
    - Following trenching and spoil disposal and borrow ground dredging and backfill activities, the sediment dispersion modelling predicts some secondary resuspension of sediment may occur in localised areas in Commonwealth waters due to tides, winds and waves for up to around four weeks at low concentrations.

Sediment sampling along the proposed pipeline route has demonstrated that sediments are suitable for unconfined ocean disposal with results indicating that all levels of potential contaminants of concern were below the NAGD (2009) screening levels. Therefore, sediments to be dredged (and suspended during operations) are considered to be uncontaminated and thus no toxicological impacts from the resuspension of contaminants are predicted.

Impacts from seabed disturbance on water and sediment quality will be slight. Receptor sensitivity of water and sediment quality is low (low value, open water), and therefore the Impact Significance Level of seabed disturbance on water and sediment quality is **Negligible (F)**.

Epifauna and Infauna

Seabed disturbance and potential impacts to epifauna and infauna may occur as a result of the mobilisation and/or displacement of sediments along the trunkline and during borrow ground dredging activities. Disturbance to the seabed can alter the physical seabed habitat conditions, resulting in epifauna and infauna community changes (Newell et al., 1998). Potential impacts include:

- Direct impacts, including physical removal and irreversible loss of benthic communities and habitat and temporary alteration of the existing hydrodynamic regime within the direct footprint of activities.
- Indirect impacts caused by reduced water quality or increased sedimentation, including indirect effects on filter feeder-sponge habitat through reduced light availability for photosynthesis of the sponges' symbionts and reduced filtering and feeding (Abdul Wahab et al., 2019).

The below discusses the potential epifauna and infauna impacts for individual activities:

- Dredging, spoil disposal and backfill activities will alter the seabed habitats over which the activities occur, resulting in epifauna and infauna community changes. Direct impacts from these activities may occur in areas described in **Section 4.5.** Noting following trunkline installation, sand from backfill operations may settle in a wider corridor beyond the 30 m average trunkline disturbance corridor, but is expected to settle in a thin layer beyond the immediate area of material distribution. The overall trunkline disturbance area allows for the distribution of some sediments to be wider than 30 m as in some areas it is significantly less than 30 m.
- Sediment dispersion modelling of trunkline trenching and spoil disposal (within Spoil Ground 5A), and borrow ground dredging and associated backfill activities in Commonwealth waters found detectable changes in water quality (as represented by the ZoI), however the increases in suspended sediment concentrations are not predicted to exceed thresholds that may cause an impact to benthic biota (as represented by the lack of ZoMI). Noting the ZoI does not represent an instantaneous plume footprint at any point in time, but rather a composite of all of the predicted maximum extents of dredge plumes.
- The habitats likely to be present along the trunkline between KP 32 and KP 50 (including Spoil Ground 5A) are detailed in **Section 4.5**. Epifaunal communities are classed as sparse and of low diversity in the vicinity of the proposed trunkline between KP 32 and KP 50. Both epifaunal and infaunal communities are considered representative of the area and are similar to those observed in other regional studies where seabed sediments consist of silty to coarse sands, typical of the North West Shelf (Keesing, 2019; Advisian, 2019b). Drop camera surveys completed in Spoil Ground 5A prior to its use for the Pluto LNG Foundation project showed that benthic communities and habitats were sparse, and current coverage is expected to be similar. Spoil Ground 5A is a previously disturbed area, and as such, the use of this ground will not destroy, fragment or disturb significant epifaunal or infaunal communities. The proposed trunkline route has been selected to avoid sensitive habitats as far as practicable and utilises existing routes established as part of the Pluto LNG Foundation project.
- Borrow ground dredging will occur within the Offshore Borrow Ground with approximately 2 Mm^3 expected to be sourced, over an area of about 17 km^2 (of which about 4 km^2 is expected to be disturbed). This area consists of bare substrate with large areas of seabed largely devoid of any epibenthic species (**Section 4.5**). Drop camera surveys (Advisian, 2019c) indicated anemones and crinoids occur at ~5% density, and were only observed at two of twenty nine sites surveyed. Direct impacts from dredging on the epifauna and infauna will there for me limited due to low density cover. Beyond this direct disturbance area, modelling (RPS, 2020) has shown that the elevations in turbidity as a result of dredging operations adjacent to the Dampier AMP, will remain below the intensity-duration thresholds predicted to cause an impact to benthic communities.

The magnitude of impacts from seabed disturbance on epifauna and infauna from trenching, spoil disposal and backfill operations is assessed to be minor. Receptor sensitivity of epifauna and infauna is low (low value, homogenous). The Impact Significance Level of seabed disturbance on epifauna and infauna has therefore been identified as **Slight (E)**.

Coral

Dredging, spoil disposal and backfill activities have the potential to impact coral as a result of elevated concentrations of suspended sediment (turbidity), changes in light quality and quantity, and sedimentation (Jones et al. 2016). Elevated turbidity within the water column reduces light penetration and therefore the availability of light for photosynthesis (Erftemeijer et al. 2012). While, elevated sedimentation rates may also suppress coral growth and survival when energy expenditure is redirected to actively clear settled sediments from coral tissue (Erftemeijer et al. 2012; Jones et al. 2016).

Coral communities of the Dampier Archipelago predominantly occur as narrow linear features fringing the shorelines of islands and the Burrup Peninsula, typically between 2 m and 10 m mean lower low water (Blakeway and Radford, 2005; Jones, 2004). Within Commonwealth waters, geophysical surveys coupled with environmental data found that the trunkline route consists of carbonate sands with some finer components, which supports sparse filter feeder communities. Similarly, preliminary findings from the benthic habitat survey completed in the Borrow Ground Project Area and adjacent areas of the Dampier AMP found that benthic habitat within the Borrow Grounds Project Area and the adjacent area of the Dampier Marine Park Habitat Protection Zone (IV) consisted of sand with little to no biota throughout the area. As such no direct disturbance to coral communities from installation and seabed intervention activities is expected.

Modelling has been completed that considers impacts to benthic communities and habitats in Commonwealth and State waters, including coral habitats of the Dampier Archipelago and inshore of the proposed Borrow Ground (RPS 2020). Modelling has shown that trenching and spoil disposal and borrow ground dredging and backfill activities undertaken in Commonwealth waters are predicted to cause detectable changes in water quality from elevated suspended sediment concentrations (as represented by the ZoI). However, increases in suspended sediment levels are predicted to remain below the intensity, duration thresholds at which impacts to benthic biota may occur. This includes the coral assemblages of the Dampier Archipelago and on the seaward slopes of outer islands such as Legendre Island and around Madeleine Shoals. Modelling has also shown that SSC levels are predicted to be an order of magnitude below the SSC levels required to sustain a sedimentation rate close to that reported as having effects on benthos (Duckworth et al., 2017).

Marine Turtles

Five species of marine turtle may occur in the Operational Area: flatback, green, hawksbill, loggerhead and leatherback turtles. The Operational Area overlaps internesting habitat critical and BIAs (internesting buffer) for flatback, green and hawksbill turtles around the Dampier Archipelago and Montebello Islands (**Section 4.6**). Activities in proximity to these sensitive locations are limited to the trenching and backfill along the trunkline route (KP 32 to KP 50), dredging within the Offshore Borrow Ground Project Area and disposal of material in Spoil Ground 5A. There is no overlap with foraging BIAs for any turtle species.

The Recovery Plan for Marine Turtles in Australia (DoEE, 2017) identifies habitat modification from infrastructure/coastal development as a threat to the stocks of flatback, green, and hawksbill turtles in the North West Shelf and Pilbara region.

Flatback, green and hawksbill turtles have an omnivorous diet; with flatbacks feeding mainly on algae and a variety of invertebrates (molluscs, soft corals, sea cucumbers and jellyfish), hawksbills primarily targeting sponges but also consuming seagrass and invertebrates (shrimp, squid, anemones, sea cucumbers and soft corals), and green turtles eating seagrass, macroalgae and jellyfish. Impacts from seabed disturbance on epifaunal communities may result in some changes to, and/or loss of, foraging habitat for marine turtles, or displacement of individual turtles from areas utilised as foraging habitat.

Internesting behaviours exhibited by flatback turtles extend further offshore compared to other marine turtle species in the NWMR. However, tracking data indicates that flatback turtles in the NWMR travel and forage in relatively shallow coastal waters less than 70 m deep (Chevron Australia Pty Ltd, 2015). The 60 km internesting buffer for flatback turtles in the Recovery Plan for Marine Turtles in Australia (DoEE, 2017) is based primarily on the movements of tagged internesting flatback turtles along the North West Shelf from a 2014 study, which found that flatback turtles may demonstrate internesting displacement distances up to 62 km from nesting beaches (Whittock et al., 2014). However, these movements were confined to longshore movements in nearshore coastal waters or travel between island rookeries and the adjacent mainland (Whittock et al., 2014). The flatback turtle internesting habitat along the North West Shelf has since been defined more precisely using satellite tracking of 47 turtles, combined with a range of environmental variables (Whittock et al., 2016). Suitable internesting habitats were identified as water depths of 0 – 16 m, within 5 – 10 km of the coastline. These were located close to a number of known flatback turtle rookeries within the region. Unsuitable internesting flatback habitats were identified as water depths of > 25 m depth and > 27 km from the coastline. The primary environmental variables that influenced flatback internesting movements were bathymetry, distance from coastline and sea surface temperature (Whittock et al., 2016a).

Suitable internesting habitat for green turtles is also likely to be limited to relatively shallow waters within close proximity of the coastline. While information on internesting movements of green turtles in Western Australia is limited, tracking data has shown that during nesting periods, female green turtles typically inter-nest in shallow, nearshore waters between 0 and 10 m deep (Pendoley, 2005) and remain <5 km nesting beaches on Barrow Island, Varanus Island, and Rosemary Island (Pendoley, 2005) and within 10 km of nesting beaches on the Lacepede Islands (Waayers et al., 2011). Other international studies also suggest internesting grounds for green turtles are located close to nesting beaches, in 10–18 m of water (Stoneburner, 1982; Mortimer and Portier, 1989; Maylan, 1995; Tucker et al., 1995; Starbird and Hills, 1992). Hays et al. (2000) deployed time-depth recorders on green turtles that had nested on Ascension Island in the South Atlantic, to examine their diving behaviour during the subsequent internesting interval. Dive profiles indicated turtles remained at a fixed depth for an extended period, surfacing briefly, before diving to the same depth. The maximum depth routinely reached was between 18 to 20 m and > 20 m resting dives were extremely rare (Hays et al., 2000).

Female hawksbill turtles have been reported to remain within 10 km of their nesting beaches on Varanus Island, and within 1 km on Rosemary Island (Pendoley, 2005).

The shallowest point of the Trunkline Project Area occurs in waters adjacent to the Dampier Archipelago (approximately 30 m depth). In the Offshore Borrow Ground Project Area, water depths range between 30 to 40 m, and internesting green and hawksbill turtles are unlikely to utilise the habitats at these depths. Therefore, seabed disturbance within the Trunkline and Offshore Borrow Ground Project Areas is not expected to adversely impact on biologically important behaviours or biologically important habitat, including habitat critical to the survival of marine turtles. The Operational Area is not likely to represent important internesting habitat for flatback, green and hawksbill turtles, and any displacement of individuals from areas utilised as foraging habitat will not result in any significant impacts at a population level.

Impacts from seabed disturbance on marine turtles will be slight. Receptor sensitivity of marine turtles is high, and the Impact Significance Level of seabed disturbance on marine turtles is **Minor (D)**.

Cultural Heritage

Section 4.9.1.2 outlines an assessment of the prospectivity for archaeological sites along the Scarborough pipeline route and its development envelope beginning at the Burrup Peninsula and ending at the edge of the continental shelf (UWA, 2021). This assessment concluded the development was likely to have “nil to low impact” on Indigenous archaeological values across the project footprint in Commonwealth waters (UWA,2021). In particular, there will be no impact to submerged igneous rock, which could have the potential to preserve petroglyphs with similar heritage values to those within the NHP onshore. The study found the outer shelf does possess a highly prospective cultural landscape with the potential to yield in situ material evidence of scientific and cultural significance, but this area is not subject to seabed disturbance impacts from trenching and spoil disposal and borrow ground dredging and backfill . Receptor sensitivity is high, and the Impact Significance Level of seabed disturbance on cultural heritage is therefore **Minor (D)**.

Australian Marine Parks

The offshore borrow ground dredging will occur adjacent to the Dampier AMP, with a 250 m buffer applied from the Marine Park boundary to avoid accidental incursion. 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. A 2017 survey of the park reported sponges to account for 20 – 50% of biota, including several rare and endemic species (Keesing et al., 2019). The park includes a Habitat Protection Zone which provides for the conservation of ecosystems, habitats and native species as a result of the high biodiversity and natural values.

Sediment dispersion modelling (RPS, 2020) for dredging in the Offshore Borrow Ground Project Area has indicated that detectable water quality changes (as represented by the ZoI) are not predicted within the National Park Zone (II) of the Dampier AMP. Furthermore, elevated suspended sediment concentrations within the Habitat Protection Zone (IV) of the Dampier AMP are predicted to remain below the intensity-duration thresholds that may cause an impact to benthic biota (as represented by the lack of ZoMI). Impacts from dredging in the offshore borrow ground are therefore not inconsistent with the objectives of the zoning of the Dampier AMP. Dredging in the Offshore Borrow Ground Project Area is not expected to modify, destroy, fragment, isolate or disturb an important or substantial area of habitat in the Dampier AMP. Sea dumping activities will be undertaken in accordance with permits under the *Environment Protection (Sea Dumping) Act 1981*.

Impacts from seabed disturbance on the Dampier AMP will be slight. Receptor sensitivity of AMPs is high (high value habitat).The Impact Significance Level of seabed disturbance on the Dampier AMP has been identified as **Minor (D)**.

Summary of Assessment Outcomes

Receptor	**Impact**	**Receptor Sensitivity Level**	**Magnitude**	**Impact Significance Level / Risk Consequence**
Water quality	Change in water quality	Low value	Slight	Negligible (F)
Sediment quality	Change in sediment quality	Low value	Slight	Negligible (F)
Epifauna and infauna	Change in habitat	Low value	Minor	Slight (E)
Coral	Change in habitat	High value	Slight	Minor (D)
Marine turtles	Change in habitat Injury/mortality to fauna	High value	Slight	Minor (D)
AMPs	Change in habitat Change in water quality	High value	Slight	Minor (D)
Cultural heritage	Disturbance to indigenous archaeological sites	High value	Slight	Minor (D)

Overall Impact Significance Level/ Risk Consequence: The overall impact significance level for disturbance to benthic habitat from trenching and spoil disposal, and borrow ground dredging and backfill activities is D based on a minor impact to the most sensitive receptors (marine fauna, AMPs and Cultural Heritage). The impact significance levels for individual receptors are consistent with the levels rated in the Scarborough OPP. Cultural Heritage is a new risk not included in the Scarborough OPP

Demonstration of ALARP				
Control Considered	***Control Feasibility (F) and Cost/Sacrifice (CS)***	***Benefit in Impact/Risk Reduction***	***Proportionality***	***Control Adopted***
Legislation, Codes and Standards				
Comply with in force Sea Dumping Permit (No. SD2019/3982 or amended), which includes the following: • Contractor must only dump within the disposal site. • Contractor must ensure the dredged material is dumped in a manner over the disposal site to minimise mounding from dumping activities. • Contractor must establish by GPS that, prior to dumping, the vessel is within the disposal site.	F: Yes CS: Significant costs associated with the studies and development of a sea dumping permit.	Implementation of the control provides regulation of sea dumping and includes an impact assessment to ensure environmental impact is minimised.	Control based on legislative requirements – must be adopted.	Yes **C 2.1**
Good Practice				
Implement the water quality monitoring program and tiered monitoring and management framework (TMMF) to manage water quality associated with dredging, spoil disposal and backfill activities to a level where impacts are not predicted to occur to benthic communities and habitats.	F: Yes. CS: Significant costs associated with implementing the water quality monitoring program.	Implementation of the TMMF will reduce the potential magnitude of impact as a result of dredging, spoil disposal and backfill operations. If Tier 2 or Tier 3 management triggers are breached as a result of dredging, spoil disposal or backfill activities, management actions will be implemented to reduce turbidity levels. [1] *Tier 3 triggers are based on a water quality level at which reversible impacts may occur*	Benefits outweigh cost/sacrifice.	Yes **C 2.2**
A 250 m buffer zone will be implemented between the offshore borrow ground and the Dampier AMP	F: Yes. The implementation of the buffer is feasible whilst ensuring there is enough sand available for the backfill activities. Increasing the buffer may limit the sand available for backfill resulting in the use of	This control would reduce the risk of potential direct disturbance with the Dampier AMP.	The control would significantly reduce the risk of direct disturbance within the Dampier AMP and the cost of implementation is minimal.	Yes **C 2.3**

Demonstration of ALARP				
Control Considered	***Control Feasibility (F) and Cost/Sacrifice (CS)***	***Benefit in Impact/Risk Reduction***	***Proportionality***	***Control Adopted***
	an additional borrow ground. CS: Minimal sacrifice.			
TSHD draghead will be positioned (using DGPS) within approved footprints prior to and during trenching, borrow ground dredging and backfill activities	F: Yes. It is possible to confirm location prior to and during activity CS: No sacrifice as dredging within the design footprint forms part of the base cost for the project.	This control reduces the impacts from direct disturbance as positioning has been pre-determined and confirmed.	The control would significantly reduce the risk of impacts from direct disturbance with minimal cost.	**C 2.4**
THSD overflow pipes to be raised prior to spoil or backfill transport.	F: Yes CS: Minimal cost.	Raising overflow pipes during transport will minimise potential losses of sediment during sailing and reduce the area where potential water quality changes may occur.	Benefits outweigh cost/sacrifice	Yes **C 2.5**
TSHD hopper door seals will be inspected prior to mobilisation.	F: Yes CS: Minimal cost.	Premobilisation inspection will ensure hopper door seals will minimise potential losses of sediment during sailing and reduce the area where potential water quality changes may occur.	Benefits outweigh cost/sacrifice	Yes **C 2.6**
Avoid dredging, spoil disposal and backfill activities during confirmed coral spawning windows	F: It is possible to avoid coral spawning windows, however given location in Commonwealth waters the risk of potential impacts to coral larvae is considered to be low. CS: Significant cost and schedule impacts due to delays in securing vessels for specific timeframes. The Petroleum Activities Program is due to be undertaken over 12 months with activities completed sequentially a variation in timing to coral spawning windows would result in significant delays to the project due to knock on effects.	As no impacts are expected from the Commonwealth waters activities there is no additional benefit of implementing this control for Commonwealth waters activities.	Grossly disproportionate. Implementation of the control requires considerable cost sacrifice for minimal environmental benefit. The cost/sacrifice outweigh the benefit gained.	No

Demonstration of ALARP				
Control Considered	***Control Feasibility (F) and Cost/Sacrifice (CS)***	***Benefit in Impact/Risk Reduction***	***Proportionality***	***Control Adopted***
Professional Judgement – Eliminate				
No additional controls identified.				
Professional Judgement – Substitute				
Alternative location to the Offshore Borrow Ground in Commonwealth waters	F: No. Geotechnical studies have shown that the Offshore Borrow Ground is the most suitable location to source sand backfill material. Other areas contain a higher percentage of fines. CS: Not assessed control not feasible.	Not assessed, control not feasible.	Not assessed, control not feasible.	No
Re-use of the trunkline trenched material	F: No. This option is not considered feasible. Woodside does not have a requirement for additional land area within its leases. Beach nourishment is not relevant to the coastal habitats of the Dampier Archipelago. Material contains too many fines and not enough coarse material to be acceptable for reuse as backfill. CS: Not assessed control not feasible.	Not assessed, control not feasible.	Not assessed, control not feasible.	No
Onshore disposal of unsuitable backfill material	F: Yes. It is possible to dispose of unsuitable backfill material onshore. CS: Significant cost would be involved in transiting material (e.g. additional vessels, fuel use, resources etc.). Would require additional time and presents additional risks (e.g. vessels use / transiting). Material would have to be disposed of at an onshore location which would require significant infrastructure set up.	Would negate the requirement to dispose of unsuitable backfill material in Spoil Ground 5A. However little environmental benefit as Spoil Ground 5A has previously been used for material disposal (Pluto trunkline) and there would be little to no environmental benefit of disposing of the material onshore.	Cost/sacrifice outweighs the benefit gained.	No
Professional Judgement – Engineered Solution				

Demonstration of ALARP				
Control Considered	***Control Feasibility (F) and Cost/Sacrifice (CS)***	***Benefit in Impact/Risk Reduction***	***Proportionality***	***Control Adopted***
Overflow funnels on the TSHD fitted with 'green valves'	F: Yes. Overflow funnels can be fitted with green valves. CS: A moderate level of costs is expected to fit the green valves in comparison to the base case.	These valves restrict the entrainment of air into the overflow mixture thereby minimising fines dispersal and associated turbidity. Further, the overflow material sinks more rapidly due to density effects allowing better settlement of overflow material.	The additional cost is considered acceptable considering the associated environmental benefit.	Yes **C 2.7**
Use of a drag head skirt on the TSHD	F: Yes. It is possible to install a skirt on the drag head. CS: Additional cost is required to install a skirt on the drag head.	Installing a drag head skirt will reduce the turbidity within the water column when dredging material. However given the low sensitivity surrounding environment and low risk to water quality (see modelling), benefit is marginal and would not significantly further reduce the risk.	Cost/sacrifice outweighs the benefit gained.	No
Spoil disposal to seabed via reverse pumping through TSHD drag head to seafloor	F: Yes. It is possible to reverse pump material to the seabed through the drag head. CS: Additional time is required to reverse pump. Given the volumes required to be disposed of in Spoil Ground 5A there is a significant cost.	Reverse pumping through the drag head may reduce the turbidity within the water column. However given the low sensitivity surrounding trench location environment and low risk to water quality (see modelling), benefit is marginal and would not significantly further reduce the risk.	Cost/sacrifice outweighs the benefit gained.	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 2.3.3**), Woodside considers the adopted controls appropriate to manage the impacts of seabed disturbance from activities associated with dredging (trenching and borrow ground), spoil disposal and backfill. 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 Criteria and Assessment
The Petroleum Activities Program meets the acceptability criteria (**Section 2.3.5**): • Overall impact significance levels for individual receptors are consistent with the levels rated in the Scarborough OPP. • EPOs and controls in the Scarborough OPP that are relevant to seabed disturbance have been adopted. • There are no changes to internal/external context specific to this risk from the Scarborough OPP, including issues raised during stakeholder consultation. Following consultations with DNP on the potential risks to AMPs, the DNP noted it has no objections and claims at this time.
Acceptability Statement: The impact assessment has determined that, given the adopted controls, the Petroleum Activities Program is unlikely to result in an impact significance level greater than Minor. Further opportunities to reduce the impacts have been investigated above. The adopted controls are considered consistent with industry good practice and meet the requirements of Woodside relevant systems and procedures. The potential impacts are considered broadly acceptable if the adopted controls are implemented. Therefore, Woodside considers the adopted controls appropriate to manage the impacts of seabed disturbance to a level that is broadly acceptable.

Environmental Performance Outcomes, Standards and Measurement Criteria			
EPO	***Adopted Control(s)***	***EPS***	***MC***
EPO 3 Undertake the Petroleum Activities Program in a manner that does not result in a substantial change in water quality which may adversely impact on biodiversity, ecological integrity, social amenity or human health. **EPO 4** Undertake activities within the borrow ground to not harm or cause destruction to the sea floor habitats (including significant areas of sponge habitat) of the Dampier AMP Habitat Protection Zone. **EPO 5** Undertake the Petroleum Activities Program in a manner that aims to avoid the displacement of marine turtles from important foraging habitat or from habitat critical during nesting and internesting periods. **EPO 6** Undertake the Petroleum Activities Program in a manner that will not modify, destroy, fragment,	**C 2.1** Comply with in force Sea Dumping Permit (No. SD2019/3982 or amended), which includes the following: • Contractor must only dump within the disposal site. • Contractor must ensure the dredged material is dumped in a manner over the disposal site to minimise mounding from dumping activities. • Contractor must establish by GPS that, prior to dumping, the vessel is within the disposal site.	**PS 2.1.1** Dredged material from the trench is not placed outside of approved spoil ground.	**MC 2.1.1** Dredge vessel logs show vessel positioned in designated spoil ground prior to, and during activity (as determined by GPS).
		PS 2.1.2 Bathymetric survey of the disposal site is undertaken by a suitably qualified person: • prior to the commencement of dumping activities under this permit; and • within 1 month of the completion of all dumping activities authorised under this permit.	**MC 2.1.2** Records demonstrate completion of survey by a qualified person.
	C 2.2 Implement the water quality monitoring program and tiered monitoring and management framework (TMMF) to manage water	**PS 2.2** TMMF implemented for borrow ground dredging and backfill activities	**MC 2.2.1** Water quality monitoring results and evidence of management actions implemented where required

Environmental Performance Outcomes, Standards and Measurement Criteria			
EPO	***Adopted Control(s)***	***EPS***	***MC***
isolate or disturb an important or substantial area of habitat such that an adverse impact on marine ecosystem functioning or integrity results.	quality associated with dredging, spoil disposal and backfill activities to a level where impacts are not predicted to occur to benthic communities and habitats.		
	C 2.3 A 250 m buffer zone will be implemented between the offshore borrow ground and the Dampier AMP	**PS 2.3** The TSHD drag head will not be positioned on the seabed within the 250 m buffer zone	**MC 2.3.1** Dredging logs demonstrate the TSHD drag head location
	C 2.4 TSHD draghead will be positioned (using DGPS) within approved footprints prior to and during trenching, borrow ground dredging and backfill activities	**PS 2.4** No dredging to occur outside of approved footprints	**MC 2.4.1** Dredging logs show that the TSHD drag head was positioned within approved footprints prior to and during dredging activities
	C 2.5 THSD overflow pipes to be raised prior to spoil or backfill transport.	**PS 2.5** THSD overflow pipes raised to minimise losses through overflow during transport	**MC 2.5.1** Records demonstrate overflow pipes are raised prior to spoil or backfill transport.
	C 2.6 TSHD hopper door seals will be inspected prior to mobilisation.	**PS 2.6** TSHD hopper door seals confirmed in good working order prior to mobilisation	**MC 2.6.1** Records of hopper door seal inspection
	C 2.7 Overflow funnels on TSHD fitted with 'green valves'	**PS 2.7** Green valves fitted and used during overflow for the duration of the dredging activity	**MC 2.7.1** Inspection shows green valves installed on overflow funnel

6.6.3 Physical Presence – Seabed Disturbance (Intervention and Trunkline Installation)

Scarborough OPP – Relevant Impact Assessment Section		
Section 7.1.6 – Seabed Disturbance		
Context		
Relevant Activities	**Existing Environment**	**Stakeholder consultation**
Seabed Intervention Activities – **Section 3.9** Trunkline Installation Activities – **Section 3.11** Contingent Activities – **Section 3.12**	Marine Regional Characteristics – **Section 4.2** Physical Environment – **Section 4.4** Habitats and Biological Communities – **Section 4.5**	Consultation – **Section 5**

Impact/Risk Evaluation Summary

Source of Impact/Risk	***Environmental Value Potentially Impacted***							***Evaluation***						
	Soil and Groundwater	**Marine Sediment**	**Water Quality**	**Air Quality (inc. odour)**	**Ecosystems / Habitat**	**Species**	**Socio-economic**	**Decision Type**	**Impact/Consequence**	**Likelihood**	**Current Risk Rating**	**ALARP Tools**	**Acceptability**	**Outcome**
Trunkline & ancillary structure(s) installation		✓	✓		✓	✓	✓	A	D	-	-	LCS GP PJ	Broadly Acceptable	EPO 3,5,6,7,8,9
Pipeline and infrastructure crossing support		✓	✓		✓	✓	✓	A	D	-	-			
Span rectification		✓	✓		✓	✓	✓	A	E	-	-			
PLET & Foundations installation (WA-61-L)		✓	✓		✓	✓	✓	A	E	-	-			
Continental slope crossing seabed preparation		✓	✓		✓	✓	✓	A	D	-	-			
Geotechnical surveys		✓	✓		✓	✓	✓	A	E	-	-			
ROV operations near the seabed		✓	✓		✓	✓	✓	A	E	-	-			
Underwater acoustic positioning		✓	✓		✓	✓	✓	A	D	-	-			

Description of Source of Impact/Risk

This section assesses potential impacts from seabed disturbance resulting from Trunkline and ancillary structure(s) installation, pipeline and infrastructure crossings, other intervention works including continental slope excavation, PLET and foundations installation, ROV and survey activities.

Trunkline Installation

The Trunkline is dual diameter, with the diameter between the State Waters boundary and ~KP200 being nominal 36" and the remainder of the Trunkline to the FPU being nominal 32" diameter. From the shore to around ~KP160, the Trunkline will be routed alongside the existing Pluto gas trunkline (about 100 m to the south).

Other structures installed by the PV (welded into the Trunkline during the normal lay process) include an in-line tee, two hot tap tees, foundations and ancillary structures.

The disturbacne footprint from installation of the Trunkline and other structures is expected to be approx 30m wide, along the Trunkline installation corridor.

A SWLB will install the nearshore section of the Trunkline up to around the State Waters boundary, however activities with this vessel may extend for a short distance into Commonwealth waters before handover to the PV. Anchoring will be required to moor the SWLB. Anchors will be moved as required via anchor handling tugs to move the SWLB along the trunkline route. During anchoring the seabed will be disturbed by the vessel anchor mooring system, including placement of anchors and chain/wire along the seabed, potential dragging during tensioning and recovery. Anchoring will occur within the Trunkline Project Area, up to 800 m either side of the trunkline and for approximately 3 km into Commonwealth Waters (1600 m x 3 km for anchoring footprint).

The PV may be required to temporarily moor on location via its anchor, in the case of a contingency scenario. This would be done within the Operational Area, away from subsea assets to prevent damage.

Pipeline and Infrastructure Crossings

The Trunkline route crosses existing subsea infrastructure including pipelines, flexible flowlines, umbilicals and fibre optic cables, which will require the installation of crossing supports. Three crossings lie within the Montebello AMP Multi Use Zone (**Figure 3-2**).

Indicative options for possible crossing supports and volumes are presented in **Table 6-4**. Possible crossing supports include rock berms (**Section 3.9.6.1**) and concrete mattresses (**Section 3.9.6.2**). A test dump may be carried out prior to rock berm installation within the Trunkline Project Area in a location free from existing infrastructure and not within the direct line of the trunkline route. The direct disturbance footprint will be determined by the length, number and height of the rock berms. Seabed disturbance associated with pipeline and infrastructure crossings may be over 30 m at the base for the centre rock berms, while at the tail ends of the crossings the footprint is reduced to only the pipeline width. Some settling of material may also occur wider than 30 m corridor. Where concrete mattresses are used, they will be installed either side of the existing subsea infrastructure. Typical concrete mattresses are 6 or 8 m by 3 m, with a thickness and stacking arrangement to suit the required span height, however they could be larger. This will be dependent on final design and seabed topography.

Table 6-4: Pipeline and infrastructure crossings

Crossing	KP	Support type[1]	Indicative Length[2] (m)	Indicative Width[2] (m)	Indicative Area[2] (m^2)
Reindeer Pipeline (Santos)	75	Rock berm	800	21	16,800
Fibre Optic Cable 1 (Telstra)	136	Rock berm	300	15	4,500
Fibre Optic Cable 2 (Telstra)	150	Rock berm	300	15	4,500
Wheatstone Pipeline (Chevron)	191	Rock berm	400	25	10,000
Julimar Brunello Pipeline	192	Rock berm	600	21	12,600
Pluto Pipeline	194	Rock berm	500	21	10,500
Pyxis Pipeline	212	Concrete mattresses	60	20	1,200
				Total	60,100

Note 1: Subject to final design
Note 2: Indicative only

Span Rectification

Span rectification (**Section 3.10**) may be required through the installation of structures, such as:

- concrete mattresses (typically 6 or 8 m x 3 m)

- grout bags (typically 200 kg to 2000 kg)
- rock installation
- seabed levelling and excavation (e.g. dredging using TSHD, mass flow excavators and jetting).

PLET & Foundations Installation (WA-61-L)

PLET foundations will be installed by a construction vessel and ROV. The PV will install the PLET at the end of the Trunkline and position it on top of pre-installed foundations (as described in **Section 3.11.4)**. Scour mattresses may also be installed. Localised permanent seabed disturbance will be confined to the footprint of the PLET and foundations, as well as temporary disturbance and resuspension of sediments during ROV operations.

Continental Slope Crossing Seabed Preparation

The Trunkline along the continental slope requires seabed preparation to prevent excessive bending movements in the Trunkline and associated free span lengths where excavation will take place in water depths ranging between 550 m and 650 m (**Section 3.9.5**). At about KP 209 of the Trunkline route, seabed material will be excavated and/or displaced over a length of approximately 150 m within a 300 m corridor (excluding placement of excavated material), which will allow appropriate pipeline span lengths. Approximately 5,000 – 15,000 m^3 of material may be excavated to allow for safe pipelay operations.

The primary method of excavation is planned to be undertaken using an ROV controlled large volume grab (as described in **Section 3.9.5**). Secondary options to achieve the excavation profile are methods such as: mass flow excavation, conventional ROV dredging tooling and/or jetting to create the required trench.

For the primary method, several options for lateral movement of the material are considered. These include the use of a winch connected to a clump weight offset from the trunkline centreline; the use of a connected hose system to the grab; and by vessel navigation whereby a construction vessel is moved between excavated area and adjacent material placement location for each grab cycle; or a combination of these methods. Selection of lateral movement method(s) is subject to engineering in context of the local soils and confirmation of a stable permanent side slope angle.

Typically, the seabed footprint for the placement of excavated material is 100 m to 500 m from the trunkline centreline either side. In the case of free vessel navigation, material placement location may be up to 1 km from the trench centre line. Material will be placed parallel to the trench in an area not exceeding 0.10 km^2, based on an indicative area of 200 m by 200 m on either side, including the placement of a clump weight.

The final position of excavated materials may overflow beyond proposed seabed footprint due to fluidisation of the already very soft soils in the trench profile. This is unavoidable given the soil properties. It is expected sediments will settle further afield due to hydrographic conditions. A portion of the material excavated will end up dispersed in the water column with particles settling out away from the excavated area as a result of current and gravity, typically moving material down gradient. Any undulation as a result of excavation and spoil disposal is expected to be smoothed over time due to hydrographic conditions.

Geotechnical Surveys

Geotechnical surveys to confirm the seabed sediments (typically involving in situ testing and piston/push sampling) may be required to collect data to inform installation activities (see **Section 3.9.1**). Seabed disturbance can result from placing survey equipment on the seafloor, or when collecting seabed samples and will be <1 m^2. These activities will only occur within the Trunkline Project Area.

Underwater Acoustic Positioning

Accurate positioning of mattresses, rock berms or structures on the seabed is required, and therefore long base line (LBL) and/or ultra short baseline (USBL) acoustic positioning may be required in some instances (see **Section 3.8.4**). A beacon will be deployed for LBL acoustic positioning, which is generally attached by hydrostatic release to a clump weight (approximate footprint of <1 m^2), allowing for recovery. If clump weights are used, they will be recovered.

ROV Operations

The use of an ROV is required during various Petroleum Activities Program activities (e.g., pre and post lay surveys, rock berms etc.) (see **Section 3.8.3**). Use of an ROV may result in temporary seabed disturbance and suspension of sediment 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 ROV is about 2.5 m × 1.7 m (4.25 m^2). It is noted that potential use of an ROV for continental slope crossing seabed preparation is addressed above.

Contingency Activities

Rock berms installed for infrastructure crossings may require rework by adding rock volume to reinstate berm height, width or slope angles using the RIV. Once the trunkline has been installed, sections may require de-burial in the event of a fault (or suspected fault) (**Section 3.12.10**). In the continental slope excavation area, re-profiling may also be required in case slumping/deterioration of the trench profile has occurred over time.

Equipment, materials or tools may need to be wet parked on the seabed in the Operational Area during installation of the trunkline. This could include, but not be limited to, work baskets for ROV tools, pig launcher/receiver prior/after connection to the PLET, scour mattresses etc.

Seabed Disturbance Summary

Table 6-5 provides details on the expected and maximum total seabed disturbance from Trunkline installation, pipeline and infrastructure crossings, other intervention works including continental slope excavation. All disturbance will occur within the Trunkline Project Area.

As detailed within Section 7.1.6.1 of the Scarborough OPP (SA0006AF0000002, Rev 5), the maximum allowable disturbance area of 12.9 km^2 is based on an indicative trunkline disturbance corridor width of 30 m, encompassing the trunkline for the entire 430 km (of which about 400 km are in Commonwealth waters). This is considered a conservative disturbance estimate, as while there will be a few locations along the trunkline route where seabed disturbance extends wider than 30 m (e.g. slope crossing), the average width of seabed disturbance across the entire trunkline route is expected to be less than 30 m.

Approximately 83 km of trunkline will extend into Montebello AMP between KP 109 and KP 192, equating to approximately 2.48 km^2 overlap (allowing for a 30 m disturbance area on the trunkline). Surveys (**Section 3.9.1** and **3.10.1**), pipeline and infrastructure crossing (**Section 3.9.6**) and span rectification activities (**Section 3.9.7**) may be undertaken within the AMP as part of the Petroleum Activities Program.

Table 6-5: Trunkline installation and associated activities seabed disturbance summary (Commonwealth waters)

Activity	Description	Expected disturbance area *(km^2)*	Maximum allowable disturbance area (*km^2*)
Trunkline installation	Trunkline on seabed and ancillary structures	2.07	11.46[1]
	Pipeline and infrastructure crossings (see summary above)	0.06	
	Continental slope crossing seabed preparation (and material placement)	0.10	

Note 1: This value has been amended to account for Commonwealth waters only (e.g. 400 km trunkline) and to remove potential duplication associated with trenching, spoil disposal and backfill between KP32 and KP50 which has been allowed for in **Section 6.6.2**.

Detailed Impact Assessment

Assessment of Potential Impacts

Seabed disturbance has the potential to result in the following impact(s):

- a change in habitat
- a change in water and sediment quality.

Which may have the following further impacts

- injury and/or mortality to fauna.

These are described in full in Section 7.1.6 of the Scarborough OPP (SA0006AF0000002, Rev 5), with no additional impacts identified for this EP. Where activities are consistent with those described in the Scarborough OPP, this section provides a summary of the assessment outcomes in the context of the Petroleum Activities Program covered by this EP. Where additional definition in relation to risks and impacts are available, this section provides additional detail as part of the impact assessment.

Water and Sediment Quality

The installation of the subsea infrastructure, including the trunkline and PLET/foundations; span rectification and pipeline and infrastructure crossings (e.g. rock berms, mattresses); and anchors for the SWLB (if required) will result in temporary and localised displacement of surface sediments within the Trunkline Project Area. The displacement of naturally occurring sediments from these activities is likely to result in highly localised (within tens of metres of the disturbance area) and low level increases in turbidity at the seabed that will quickly disperse in the oceanic marine environment due to prevailing hydrodynamic conditions. Any reduction in water quality is likely to be temporary, and limited to the waters close to the seabed immediately surrounding the disturbance area. The resulting low levels of sediment deposition are likely to be naturally reworked into surface sediment layers through bioturbation.

Continental slope crossing seabed excavation will result in sediment mobilisation from displacement/relocation of sediments along the trunkline at approximately KP 209, subsequently resulting in a localised and temporary change in water quality. Sediments of the continental slope are typically soft sediments and mud, and as such excavated materials may overflow beyond proposed seabed footprint due to fluidisation of the already very soft soils in the trench profile. It is expected a portion of the material excavated will end up dispersed in the water column with finer particles likely to settle further afield due to hydrographic conditions, typically moving material down gradient. The short term nature of the activity means that elevations is turbidity at depth is likely to be temporary in nature and rapidly return to background levels.

Impacts from seabed disturbance on water and sediment quality will be slight. Receptor sensitivity of water and sediment quality is low (low value, open water), and therefore the Impact Significance Level of seabed disturbance on water and sediment quality is **Negligible (F)**.

Epifauna and Infauna

Seabed disturbance and potential impacts to epifauna and infauna will occur as a result of the mobilisation and/or displacement of sediments along the trunkline and placement of infrastructure. Disturbance to the seabed can alter the physical seabed habitat conditions, resulting in epifauna and infauna community changes (Newell et al., 1998). Potential impacts include:

- Direct impacts, including physical removal and irreversible loss of benthic communities and habitat and temporary alteration of the existing hydrodynamic regime within the direct footprint of activities.
- Indirect impacts caused by reduced water quality or increased sedimentation, including indirect effects on filter feeder-sponge habitat through reduced light availability for photosynthesis of the sponges' symbionts and reduced filtering and feeding (Abdul Wahab et al., 2019).

The installation of the subsea infrastructure, including the trunkline; and PLET/foundations; span rectification and pipeline and infrastructure crossings (e.g. rock berms, mattresses); and anchors for the SWLB (if required) will result in permanent and localised loss of epifauna and infauna over the infrastructure footprint. As detailed in **Section 4.5.2,** the Trunkline Project Area is not expected to support abundant or diverse benthic communities, and those that are present are considered typical of the North West Shelf.

The trunkline route intersects the Montebello AMP between KP 109 and KP 192, however the dominant benthos (sponges, soft corals, gorgonians, hydroids, sea pens, crinoids) are widely representative of benthos found both within the AMP (Advisian, 2019a) and regionally. Potential impacts to the values of the AMP are evaluated further below. The magnitude of impact to epifauna and infauna within the Trunkline Project Area will be minor given the localised footprint of disturbance and associated temporary increase in turbidity.

In the long term, the trunkline, PLET and foundations, span rectification and infrastructure crossing materials will provide hard substrate to the marine environment for the duration of the activity, which may support epifaunal communities. Habitats and the species present on these types of structures in the NWS of Western Australia have been subject to detailed assessment by McLean et al. (2020), McLean et al. (2018), Bond et al. (2018) and McLean et al. (2017). These habitats not only have structural complexity but also create habitat for a large diversity of fish species that commonly occur elsewhere in the NWS but do not occur over soft unconsolidated sediments.

Continental slope crossing seabed preparation at approximately KP 209 is expected to result in direct impacts to epifauna and infauna within the excavation footprint and area of material relocation. Sediment mobilisation is expected to be limited to a distance of a few hundred metres from the deposition location, but may extend further based on geotechnical properties and tendency of sediments to relocate typically down-gradient, similar to natural relocation of sediments in this area.

Temporary elevations in turbidity and subsequent sediment deposition also have the potential to indirectly affect filter feeder-sponge habitat through smothering. Given the volume and soil type (soft sediments and mud), minor elevations in turbidity are expected near the seabed, with low levels of sediment deposition further afield. Based on ROV transects undertaken in the area (Advisian, 2019a), the seabed within the KP 209 area is expected to be predominantly bare sand habitat with a sparse coverage of epibenthic organisms, such as heterotrophic sponges and soft corals.

Rock pinnacles have been observed approximately 3 km from the slope crossing seabed preparation location. However, impacts from turbidity on species associated with these formations are not expected given the distance and that the pinnacles are located upslope of the trunkline whereas sediments are expected to deposit downslope. Impacts to the values of the Continental Slope Demersal Fish Communities KEF, which intersects the continental slope crossing seabed preparation area, are evaluated below.

Impacts from seabed disturbance on epifauna and infauna will be minor. Receptor sensitivity of epifauna and infauna is low (low value, homogenous).The Impact Significance Level of seabed disturbance on epifauna and infauna has been identified as **Slight (E)**.

Marine Turtles

Five species of marine turtle may occur in the Trunkline Project Area: flatback, green, hawksbill, loggerhead and leatherback turtles. The Trunkline Project Area overlaps internesting habitat critical and BIAs (internesting buffer) for flatback, green and hawksbill turtles around the Dampier Archipelago and Montebello Islands (**Section 4.6**).

The Recovery Plan for Marine Turtles in Australia (DoEE, 2017) identifies habitat modification from infrastructure/coastal development as a threat to the stocks of flatback, green, and hawksbill turtles in the North West Shelf and Pilbara region.

Based on the defined 30 m width of the indicative Trunkline disturbance area, the areas of overlap with the habitat critical to each species of marine turtle are as follows:

- Flatback turtle: habitat critical – overlap area 5.17 km^2; 0.012%.
- Green turtle: habitat critical – overlap area 0.62 km^2; 0.013%.

- Hawksbill turtle: habitat critical – overlap area 0.62 km^2; 0.013%.

Potential impacts to turtles from dredging, spoil disposal and backfill activities are assessed in **Section 6.6.2**. Impacts from seabed disturbance during trunkline installation and associated activities will be highly localised and temporary in nature. It is unlikely that internesting turtles will occur in the Trunkline Project Area near the Montebello Islands, where water depths range between 46 m to 214 m (as described in **Section 6.6.2**). These deep, offshore waters at the furthest extent of the internesting buffer habitat critical are not likely to represent important internesting habitat, as described in **Section 6.6.2.** Therefore, seabed disturbance within the Trunkline Project Area near the Montebello Islands is not expected to displace turtles from the internesting buffer habitat critical.

Whilst the Trunkline Project Area adjacent to the Dampier Archipelago overlaps internesting buffer habitat critical for flatback, green and hawksbill turtles (refer **Figure 4-7**), the extent of overlap between the defined 30 m width of the indicative Trunkline disturbance area and these habitat critical areas is extremely low (<0.02% - see above). The shallowest point of the Trunkline Project Area occurs in waters adjacent to the Dampier Archipelago (approximately 30 m depth), and internesting flatback, green and hawksbill turtles are unlikely to utilise the habitats at these depths. Therefore, seabed disturbance within the Trunkline Project Area adjacent to the Dampier Archipelago is not expected to adversely impact on biologically important behaviours or biologically important habitat, including habitat critical to the survival of marine turtles. The Operational Area is not likely to represent important internesting habitat for flatback, green and hawksbill turtles, and any displacement of individuals from areas utilised as foraging habitat will not result in any significant impacts at a population level.

Impacts from seabed disturbance on marine turtles will be slight. Receptor sensitivity of marine turtles is high, and the Impact Significance Level of seabed disturbance on marine turtles is **Minor (D)**.

Cultural Heritage

Section 4.9.1.2 outlines an assessment of the prospectivity for archaeological sites along the Scarborough pipeline route and its development envelope beginning at the Burrup Peninsula and ending at the edge of the continental shelf (UWA, 2021). This assessment concluded the development was likely to have "nil to low impact" on Indigenous archaeological values across the project footprint in Commonwealth waters (UWA, 2021). In particular, there will be no impact to submerged igneous rock, which could have the potential to preserve petroglyphs with similar heritage values to those within the NHP onshore. The study found the outer shelf does possess a highly prospective cultural landscape with the potential to yield in situ material evidence of scientific and cultural significance but "the pipeline route itself does not cross any [archaeologically] culturally significant landforms or features" (UWA, 2021). The report also concluded that "The method of laying the pipeline here… minimises the likely impact on potential heritage" (UWA, 2021). Receptor sensitivity is high, and the Impact Significance Level of seabed disturbance on cultural heritage is therefore **Minor (D)**.

Australian Marine Parks

The Trunkline Project Area intersects the Montebello AMP (Multiple Use Zone (VI)) between KP 109 to KP191. This equates to an approximate 2.48 km^2 overlap (allowing for a 30 m disturbance area for the trunkline). This conservative disturbance area represents 0.07% of the Montebello Marine Park, including the area intersecting the Ancient Coastline KEF. Between KP 109 and KP 160 the trunkline will be routed alongside the existing Pluto gas trunkline (about 100 m to the south). The trunkline will be nominal 36 inches in diameter and will be installed by the DP PV through the Montebello AMP, therefore no mooring will be required.

A description of the epifaunal communities in the Montebello Islands AMP is provided in **Section 4.8**. The trunkline intersects an area of sparse epifauna in the South Eastern section of the AMP and intersects areas of slightly more abundant and diverse epifauna in the North Western section of the AMP (Advisian 2019a and 2019b, Keesing 2019). However these areas are typical of the benthos found both within the marine park and regionally. Benthic organisms (including sponges and soft corals) generally occur as single or low density aggregations of individuals with isolated denser areas of sponges in areas identified from the bathymetry as having a more complex seabed structure (Advisian, 2019b).

The pipeline alignment was selected to ensure the intersections with harder more complex areas of seabed are minimised with the pipeline generally running perpendicular to these areas. This minimises any direct loss of sponges which are generally associated with these areas of more complex bathymetry in the Montebello AMP. The majority of the trunkline route within the Montebello AMP will also run adjacent to the existing Pluto trunkline ensuring there is minimal disturbance to new areas of the AMP. The trunkline route has also been selected to minimise the seabed disturbance, with alternative options requiring additional seabed intervention (refer to Section 4.5.and 4.6 of the Scarborough OPP).

Three infrastructure crossings lie within the Montebello AMP Multi Use Zone, which will require the use of rock berms (refer to **Section 3.9.6.1**). The expected average footprint for seabed disturbance associated with infrastructure crossing materials is the 30 m disturbance corridor, however in some sections may be narrower or wider.

Given that epifaunal communities are well represented either side of the proposed trunkline route (Advisian 2019) and regionally (Keesing 2019) and that the footprint of the trunkline is extremely small in comparison with the spatial extent of these communities in the North Western section of the Montebello AMP, the presence of the trunkline will not destroy, fragment, isolate these communities. Nor will it disturb a substantial area of habitat given the narrow footprint of the trunkline. In the long term, the trunkline and crossing materials will provide hard substrate to the marine environment for the duration of the activity, which may support epifaunal communities (McLean et al. 2020; McLean et al. 2018; Bond et al. 2018; McLean et al. 2017).

Relevant critical habitat and BIAs that intersect the Trunkline Project Area in the Montebello AMP include an internesting buffer and an internesting BIA for flatback turtles. The conservative disturbance area of approximately 2.48 km^2 represents <0.01% of the habitat critical for flatback turtles around the Montebello Islands, and the relatively deep offshore waters where the trunkline disturbance corridor overlaps the northern extent of the Montebello AMP (46 m to 214 m) do not represent important internesting habitat for flatback turtles (refer above). Impacts to foraging habitat for turtles in this area from seabed disturbance are expected to be minimal given the limited area of disturbance and sparse epifaunal communities.

Impacts from seabed disturbance on the Montebello AMP will be slight. Receptor sensitivity of AMPs is high (high value habitat).The Impact Significance Level of seabed disturbance on AMPs has been identified as **Minor (D)**.

KEFs

Three KEFs overlap the Operational Area (Table 6-6). The location and values of the KEFs are summarised below:

- Exmouth Plateau KEF (intersects the Trunkline Project Area at KP 375 for about 60 km): Values and sensitivities are related to seafloor features. These seafloor features may promote enhanced upwelling.
- Ancient Coastline KEF (intersects the Trunkline Project Area at KP 200 for about 3 km): The KEF includes areas of hard substrate, and higher diversity and species richness relative to surrounding areas of predominantly soft sediment. The submerged coastline may facilitate mixing of the water column enhancing productivity. Combined with greater diversity of sessile benthic organisms, this may increase abundance of pelagic species such as fishes and cetaceans, impacts to which are discussed above.
- Continental Slope Demersal Fish Communities KEF (intersects the Trunkline Project Area at KP 201 for about 9 km). The KEF represents high levels of endemism of demersal fish species.

Small areas of seabed in three KEFs will be disturbed as a result of activities associated trunkline installation. Activities within each of the KEFs and associated seabed disturbance area are detailed in Table 6-6.

Table 6-6: Potential Petroleum Activities Program within KEFs and disturbance

KEF	Activities which may occur within KEF	Disturbance within KEF (%) based on 30 m disturbance
Exmouth Plateau KEF	Trunkline installation and span rectification	<0.0035
Ancient Coastline at 125 m Depth Contour KEF	Trunkline installation and span rectification	<0.0004
Continental Slope Demersal Fish Communities KEF	Trunkline installation and continental slope crossing seabed preparation[1]	<0.0007

[1] Note that the final position of excavated materials from continental slope crossing seabed preparation may disperse beyond proposed seabed footprint due to fluidisation of the already very soft soils in the trench profile.

Physical habitat modification is not listed as a potential concern for Exmouth Plateau KEF or Ancient Coastline at 125 m Depth Contour KEF and therefore impacts to the values of these KEFs are not anticipated. Physical habitat modification is listed as a potential concern for the Continental Slope Demersal Fish Communities KEF; however, the total impact area is small, and impacts will be highly localised to the Trunkline Project Area

Impacts are not likely to be significant from trunkline installation and associated activities as the disturbance will occur in a small proportion of each of the KEFs and avoids important or substantial areas of habitat, including hard substrates of the Ancient Coastline at 125 m Depth Contour KEF.

Impacts from seabed disturbance to the KEFs will be slight. Receptor sensitivity of KEFs is high (high value), and therefore Impact Significance Level of seabed disturbance on KEFs is **Minor (D)**.

Total Seabed Disturbance

Table 6-7 provides details on the expected and maximum total seabed disturbance from seabed intervention and trunkline installation activities as defined in **Section 6.6.2** and **6.6.3**. All disturbance will occur within the Trunkline Project Area and Borrow Ground Project Area

Table 6-7: Estimated seabed disturbance summary (Commonwealth waters)

Activity	Description	Expected disturbance area *(km^2)*	Maximum allowable disturbance area (*km^2)*

Trunkline installation	Pipelay on seabed	2.07	12[1]
	Pipeline and infrastructure crossings (see summary above)	0.06	
	Continental slope crossing seabed preparation (including material placement)	0.10	
Trunkline trenching, spoil disposal and backfill	Trunkline trenching and backfill[2]	0.24	
	Spoil Ground 5A material disposal[3]	1.60	
Offshore borrow ground dredging	Dredging within offshore borrow ground to source material for backfill	4.00	17

Note 1: Expected disturbance area assumes Commonwealth waters only
Note 2: Expected disturbance area assumes KP32 to KP40, although impact assessment and maximum extent is to KP50
Note 3: Disturbance located within previously disturbed ground

Summary of Assessment Outcomes

Receptor	Impact	Receptor Sensitivity Level	Magnitude	Impact Significance Level
Water quality	Change in water quality	Low value	Slight	Negligible (F)
Sediment quality	Change in sediment quality	Low value	Slight	Negligible (F)
Epifauna and infauna	Change in habitat	Low value	Minor	Slight (E)
Cultural Heritage	Disturbance to indigenous archaeological sites	High value	Slight	Minor (D)
Marine turtles	Change in habitat Injury/mortality to fauna	High value	Slight	Minor (D)
AMPs	Change in habitat Change in water quality	High value	Slight	Minor (D)
KEFs	Change in habitat Change in water quality Injury/mortality to fauna	High value	Slight	Minor (D)

Overall Impact Significance Level: The overall impact significance level for disturbance to benthic habitat from trunkline installation and associated activities is D based on a minor impact to the most sensitive receptors (marine fauna, AMPs and KEFs). The impact significance levels for individual receptors are consistent with the levels rated in the Scarborough OPP Noting that cultural heritage is a new risk not included in the Scarborough OPP.

Demonstration of ALARP

Control Considered	***Control Feasibility (F) and Cost/Sacrifice (CS)***	***Benefit in Impact/Risk Reduction***	***Proportionality***	***Control Adopted***
Legislation, Codes and Standards				
No additional controls identified.				

Demonstration of ALARP				
Control Considered	***Control Feasibility (F) and Cost/Sacrifice (CS)***	***Benefit in Impact/Risk Reduction***	***Proportionality***	***Control Adopted***
Good Practice				
Infrastructure will be placed on the seabed within the design footprint using positioning technology	F: Yes. This is a standard practice and benefits project requirements aiding placement as per design requirements. CS: Costs associated with improved accuracy/tolerance for implementation	Positioning infrastructure within the design footprint will reduce the potential magnitude of impact.	Benefits outweigh cost/sacrifice	Yes **C 3.1**
Span rectification design for the continental slope crossing is engineered such that seabed excavation is minimised	F: Yes. This is considered good practice. CS: Costs associated with excavation of minimum amount of material to achieve the required design parameters. However cost benefits may also be realised should excavation duration be shortened as a result of reduced excavation requirements.	Avoids unnecessary excavation and hence disturbance of seabed sediments.	The control would significantly reduce the risk of impacts from direct seabed disturbance. Reducing excavation volumes may also reduce project costs (e.g. time).	Yes **C 3.2**
Excavated material for the continental slope crossing will be placed in a designated areas parallel to the trench.	F: Yes. This is considered good practice. CS: Costs associated with placement accuracy	Placing excavated material within designated areas will reduce the potential magnitude of impact.	Benefits outweigh cost/sacrifice	Yes **C 3.3**
If rock placement test dumps are required, they will be conducted within the indicative 30 m trunkline corridor.	F: Yes. CS: Minimal cost. Standard Practice.	Test dumping within the 30 m disturbance footprint will limit the area where potential impacts may occur.	Benefits outweigh cost/sacrifice	Yes **C 3.4**
Anchoring procedures to guide the setting of anchors for the SWLB (if required) and include: • Accurate positioning of anchors • Prevention of excessive anchor wire drag on the seabed by ensuring sufficient tension is maintained during anchor running operations. • Anchoring equipment certification (winches, anchor wires and associated hardware)	F: Yes. CS: Minimal cost. Standard Practice.	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 **C3.5**

Demonstration of ALARP				
Control Considered	***Control Feasibility (F) and Cost/Sacrifice (CS)***	***Benefit in Impact/Risk Reduction***	***Proportionality***	***Control Adopted***
• Anchor installation as per mooring design analysis				
Any wet parked items will be tracked and removed from the seabed.	F: Yes. CS: Minimal cost. Standard Practice.	Removing wet parked items will reduce the duration of impact.	Benefits outweigh cost/sacrifice	Yes **C3.6**
Professional Judgement – Eliminate				
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. 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 considered – control not feasible.	No
Professional Judgement – Substitute				
No additional controls identified.				
Professional Judgement – Engineered Solution				
No additional controls identified.				
ALARP Statement On the basis of the environmental impact assessment outcomes and use of the relevant tools appropriate to the decision type (i.e. Decision Type A, **Section 2.3.3**), Woodside considers the adopted controls appropriate to manage the impacts of seabed disturbance from trunkline installation and associated activities. 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 Criteria and Assessment
The Petroleum Activities Program meets the acceptability criteria (**Section 2.3.5**): • Overall impact significance levels for individual receptors are consistent with the levels rated in the Scarborough OPP. • EPOs and controls in the Scarborough OPP that are relevant to seabed disturbance have been adopted. There are no changes to internal/external context specific to this risk from the Scarborough OPP, including issues raised during stakeholder consultation. Following consultations with DNP on the potential risks to AMPs, the DNP noted it has no objections and claims at this time
Acceptability Statement: The impact assessment has determined that, given the adopted controls, the Petroleum Activities Program is unlikely to result in an impact significance level greater than Minor. Further opportunities to reduce the impacts have

been investigated above. The adopted controls are considered consistent with industry good practice and meet the requirements of Woodside relevant systems and procedures.

The potential impacts are considered broadly acceptable if the adopted controls are implemented. Therefore, Woodside considers the adopted controls appropriate to manage the impacts of disturbance to seabed to a level that is broadly acceptable.

Environmental Performance Outcomes, Standards and Measurement Criteria			
EPO	***Adopted Control(s)***	***EPS***	***MC***
EPO 3 Undertake the Petroleum Activities Program in a manner that does not result in a substantial change in water quality which may adversely impact on biodiversity, ecological integrity, social amenity or human health. **EPO 5** Undertake the Petroleum Activities Program in a manner that aims to avoid the displacement of marine turtles from important foraging habitat or from habitat critical during nesting and internesting periods. **EPO 6** Undertake the Petroleum Activities Program in a manner that will not modify, destroy, fragment, isolate or disturb an important or substantial area of habitat such that an adverse impact on marine ecosystem functioning or integrity results. **EPO 7** Seabed disturbance from trunkline installation within the Montebello Marine Park will be limited to less than 0.07% of the total park area. **EPO 8** Undertake Scarborough Trunkline Installation within the Montebello AMP in a manner that will be not be inconsistent with the objective of the multiple use zone. **EPO 9** Changes to water quality in the Montebello Marine Park as a result of the	**C 3.1** Infrastructure will be placed on the seabed within the design footprint using positioning technology	**PS 3.1** All infrastructure will be placed within the Trunkline Project Area	**MC 3.1.1** Surveys demonstrate infrastructure placement
	C 3.2 Span rectification design for the continental slope crossing is engineered such that seabed excavation is minimised	**PS 3.2** Design for continental slope crossing includes consideration to reduce excavation volumes	**MC 3.2.1** Engineering drawing show reduction in excavation volumes
	C 3.3 Excavated material for the continental slope crossing will be placed in designated areas parallel to the trench	**PS 3.3** Material placed within designated areas not exceeding total area of 0.10 km2	**MC 3.3.1** Surveys demonstrate location of material placement
	C 3.4 If rock placement test dumps are required, they will be conducted within the indicative 30 m trunkline corridor.	**PS 3.4** Rock placement test dumps completed within indicative 30 m trunkline corridor	**MC 3.4.1** Surveys demonstrate test dump placement
	C 3.5 Anchoring procedures to guide the setting of anchors for the SWLB (if required) and include: • Accurate positioning of anchors • Prevention of excessive anchor wire drag on the seabed by ensuring sufficient tension is maintained during anchor running operations. • Anchoring equipment certification (winches, anchor wires and associated hardware) • Anchor installation as per mooring design analysis	**PS 3.5** Anchoring procedures developed and implemented for SWLB (if required).	**MC 3.5.1** Records show anchoring procedures developed and implemented for SWLB (if required).
	C 3.6	**PS 3.6**	**MC 3.6.1**

Environmental Performance Outcomes, Standards and Measurement Criteria			
EPO	***Adopted Control(s)***	***EPS***	***MC***
trunkline installation will be not be inconsistent with the objective of the multiple use zone.	Any wet parked items will be tracked and removed from the seabed.	All wet parked items removed.	Surveys demonstrate removal of wet parked items.

6.6.4 Routine Light Emissions from Project Vessels

<table>
<tr><th colspan="15">Scarborough OPP – Relevant Impact Assessment Section</th></tr>
<tr><td colspan="15">Section 7.1.1 – Routine Light Emissions</td></tr>
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<tr><th colspan="15">Impact/Risk Evaluation Summary</th></tr>
<tr><th rowspan="2">Source of Impact/Risk</th><th colspan="7">Environmental Value Potentially Impacted</th><th colspan="7">Evaluation</th></tr>
<tr><th>Soil and Groundwater</th><th>Marine Sediment</th><th>Water Quality</th><th>Air Quality (inc. odour)</th><th>Ecosystems / Habitat</th><th>Species</th><th>Socio-economic</th><th>Decision Type</th><th>Impact/Consequence</th><th>Likelihood</th><th>Current Risk Rating</th><th>ALARP Tools</th><th>Acceptability</th><th>Outcome</th></tr>
<tr><td>Light emissions from project vessels</td><td></td><td></td><td></td><td></td><td></td><td>✓</td><td></td><td>A</td><td>E</td><td>-</td><td>-</td><td>GP</td><td>Broadly Acceptable</td><td>EPO 5,6,10,11,12</td></tr>
<tr><th colspan="15">Description of Source of Impact/Risk</th></tr>
</table>

Vessel Operations

Project vessels will have external lighting to support safe operations at night, as well as to communicate the presence and activities of project vessels to other marine users (i.e. navigational lights). This lighting typically consists of bright white (i.e. metal halide, halogen, fluorescent) lights, and is not dissimilar to lighting used for other offshore activities, including fishing and shipping. Lighting is required for the safe operation of the project vessels and cannot reasonably be eliminated.

Project vessel light emissions in any one area will be limited by the transient nature of the works along the trunkline route and the cycling of dredging and backfill between the Offshore Borrow Ground Project Area, Trunkline Project Area and disposal of material in Spoil Ground 5A. The Petroleum Activities Program may not be executed as a single campaign or in a consecutive sequence, therefore light emissions may occur at any time during the period of the EP. Once the activities are completed, no permanent ongoing project lighting will occur in these locations.

Based on the recommendations of the National Light Pollution Guidelines for Wildlife (NLPG – Commonwealth of Australia, 2020), the Scarborough OPP (Section 7.1.1.2) considered the activities within 20 km of land, approximately 8 km into Commonwealth waters between KP 32 and around KP 40.

The TSHD and pipelay vessels have the greatest potential for impacts from light emissions based on their size (PENV, 2020a). The effect of sky glow may occur at distances greater than 20 km for some species and under certain environmental conditions; however, the 20 km threshold provides a nominal distance at which light impacts should be considered (Commonwealth of Australia, 2020). Indicative activities that will be conducted within 20 km of land, including estimated duration, are outlined in **Table 6-8**. These activities were used as assumptions for modelling of light emissions for the Petroleum Activities Program. They are therefore conservative estimates and do not necessarily reflect current vessel schedules for these activities.

Modelling undertaken (Section 7.1.1.1 of the Scarborough OPP) indicated that light emissions were predicted to reduce to ambient levels (0.01, or 1%, radiance of a full moon) at 5.7 km and 4.7 km from the PV and dredging vessel, respectively.

Table 6-8**:** Indicative trunkline installation and stabilisation activities within 20 km of land Activity (light modelling)

Activity	Estimated duration	Location	Vessels
Hydrographic, geophysical and geotechnical surveys	2-months Vessel continuously present within project areas and constantly moving	Trunkline and Borrow Ground Project Areas	Predominantly survey vessels
Pre-lay trenching and spoil disposal	8-weeks Vessel continuously present within project areas and constantly moving	Trunkline Project Area	Trailing suction hopper dredger (TSHD)
Pipelay	3.5-weeks Vessel continuously present within project areas and constantly moving	Trunkline Project Area	Pipelay Vessel
Pre-lay and post span rectifications (rock and/or mattress)	2-weeks Intermittent activity: Activities at individual location ~48 hours	Trunkline Project Area	Construction Vessel
Post-lay borrow ground dredging and backfill	8-weeks Intermittent activity: 2-hours dredging at borrow ground, material transported to trunkline for backfill. Material from borrow grounds placed in trench (up to 5-hours), return to borrow grounds	Trunkline and Borrow Ground Project Areas	TSHD vessel and support

Detailed Impact Assessment

Assessment of Potential Impacts

Routine light emissions generated by offshore activities has the potential to result in the following impact(s):

- a change in ambient light.
- a change in fauna behaviour (marine reptiles, seabirds and migratory shorebirds)
- a change to the functions, interests or activities of other users.

Ambient Light

The introduction of light emissions from activities associated with the Petroleum Activity Program can result in a temporary change to ambient light.

Existing light sources at the eastern end of the Trunkline Project Area (within 20 km of land) include heavy vessel traffic within the Pilbara Port Authority (PPA) Management area and 26 designated anchorages for bulk carriers, petroleum and gas tankers, drilling rigs, offshore platforms, and pipelay vessels located offshore of Rosemary Island. These anchorages are located between Rosemary Island and the Trunkline Project Area. Although light monitoring within the Dampier Archipelago has not been undertaken, existing light pollution in this area is expected to be high (Commonwealth of Australia, 2017a). As described above, the TSHD and pipelay vessels have the greatest potential for light emissions based on size (PENV, 2020a).

It is considered that the contribution of light emissions from the Petroleum Activities Program will be comparable with existing vessels and facilities on the NWS and will not result in a notable increase in this nearshore/PPA area.

The NLPG address potential impacts to marine turtles, seabirds and migratory shorebirds from artificial light (Commonwealth of Australia, 2020). The aim of the Guidelines is for artificial light to be managed so wildlife is: 1) not disrupted within, nor displaced from, important habitat; and 2) able to undertake critical behaviours such as foraging, reproduction and dispersal. The guidelines recommend best practice lighting design principles, however implementation of these may not always be possible when contracting existing vessels. The guidelines also recommend a specific artificial light impact assessment process where there is important habitat for listed species that are known to be affected by artificial light within 20 km of a project. 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 (Kamrowski, et al., 2014; Hodge et al., 2007) and fledgling seabirds grounded in response to artificial light 15 km away (Rodríguez et al., 2014). The Operational Area is offshore, 6.6 km from the nearest island or other emergent features and within known BIAs for turtles and seabirds/migratory shorebirds, therefore a specific study for artificial lighting is required under the guidelines, and was completed as part of the Scarborough OPP development.

Marine Turtles - Adults

The Recovery Plan for Marine Turtles in Australia 2017-2027 (Commonwealth of Australia, 2017a) identifies light pollution as a high risk threat to marine turtles in the NWS region, including the relevant stocks of green, flatback and hawksbill turtles surrounding the Operational Area. The plan indicates that artificial light may reduce the overall reproductive output of a stock, and therefore recovery of the species, by: 1) inhibiting nesting by females, 2) creating pools of light (i.e. light spill) that attract hatchlings and increased predation, and 3) disrupting hatchling behaviour and sea finding behaviour (Commonwealth of Australia, 2017a).

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, Witherington and Martin, 2003). Such lighting is typically from residential and industrial development at the coastline, rather than offshore from nesting beaches. There is no evidence, published or anecdotal, to suggest that internesting, mating, foraging or migrating turtles are impacted by light from offshore vessels. Although individuals undertaking 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, and therefore light emissions from project vessels are unlikely to result in displacement of, or behavioural changes to individuals during these life stages (PENV, 2020a).

The light modelling study by Pendoley Environmental (PENV, 2020b) as described in Section 7.1.1.2 of the Scarborough OPP, indicated that there is potential for behavioural impacts to marine turtles to occur (more than 0.01, or 1%, radiance of a full moon) within 1.8 km of the PV and within 1.5 km from the TSHD vessel. The distance between turtle nesting beaches and the Operational Area at the closest point (6.6 km to Legendre Island and >10km to closest nesting beach on Legendre Island and 14 km to Rosemary Island) are greater than the zone where behavioural impacts from vessel lighting are possible (within 1.5-1.8 km). Therefore, impacts to nesting female turtles, including discouraging females from nesting, or affecting nest site selection and sea-finding behaviour, are not predicted, and females are not expected to be displaced from nesting habitat (PENV, 2020b).

Impacts are not expected to be contrary to the priority actions or measures of success criteria outlined in the Recovery Plan for Marine Turtles (Commonwealth of Australia, 2017a) for the relevant marine turtle stocks or management of artificial light.

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. Exposure to artificial light can alter how hatchlings find the sea after emerging from their nests, and how they disperse once they are in the sea (Witherington and Martin, 2003). 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. At close distances to artificial light, 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).

As above, the light modelling of a representative PV and TSHD vessel (PENV, 2020b) indicates that light levels at the nearest nesting beaches to the Operational Area are below thresholds where behavioural impacts are possible. Therefore, impacts to hatchling emergence, including hatchling mis- or dis-orientation, are not predicted. Impacts to hatchling dispersal resulting from vessel lighting are possible but will be limited as:

- The distance between turtle nesting beaches and the Operational Area at the closest point (6.6 km to Legendre Island and >10km to closest nesting beach on Legendre Island and 14 km to Rosemary Island).
- Nearshore currents would need to carry hatchlings into the zone where behavioural impacts from vessel lighting are possible (within 1.8 km of the PV and within 1.5 km of the TSHD).
- The density of hatchlings will decrease with distance from the nesting beach as individuals disperse in open ocean.
- Nearshore currents in the region must be weaker than hatchling swimming speed in order for hatchlings to override wave cues and successfully swim toward light sources.
- The potential for attraction to vessel lighting is expected to be overridden by the radiance of the moon during full moon periods.
- Vessels within 20 km of nesting beaches will be in the area temporarily (months) during the Petroleum Activities Program, light emissions will not be ongoing.
- Vessels within the Operational Area will be continuously moving at varying speeds, particularly within the Offshore Borrow Ground Project Area where vessel presence is limited to approximately two hours at a time.
- Attraction to light sources will not occur during daylight and hatchling dispersal will resume upon sunrise.

Attraction to artificial lighting may have consequences at the individual level (e.g. energy depletion and increased predation risk), however, the number of marine turtles that could be impacted is likely to be low and undetectable against normal population fluctuations. The desktop lighting assessment by PENV (2020a) concluded that the light emissions from vessel activities in the Trunkline and Borrow Ground Project Area would not have significant impact on marine turtles across the whole life cycle.

Impacts are not expected to be contrary to the priority actions or measures of success criteria outlined in the Recovery Plan for Marine Turtles (Commonwealth of Australia, 2017a) for the relevant marine turtle stocks or management of artificial light.

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 (collision with infrastructure/vessels) near the light source (e.g. Longcore and Rich, 2004; Gaston et al., 2014; Rich and Longcore, 2006). The Operational Area may be visited by seabirds and migratory shorebirds, including the wedge-tailed shearwater, roseate tern and Australian fairy tern; however, the Operational Area is located in offshore waters, 6.6 km from the nearest island and there is no emergent land that can be used for roosting on nesting. Therefore, any presence of seabirds or shorebirds is considered likely to be of a transient nature only.

Light modelling undertaken (Section 7.1.1.1 of the Scarborough OPP) indicated that light emissions were predicted to reduce to ambient levels (0.01, or 1%, radiance of a full moon) at 5.7 km and 4.7 km from the PV and TSHD vessel, respectively. Therefore, impacts to seabirds and migratory shorebirds are expected to be localised within the vicinity of vessels, and are limited to a behavioural disturbance to isolated transient individuals, with no lasting effect or displacement from important habitats. Vessels within the Operational Area will be continuously moving at varying speeds, and temporarily in the area at any time (hours to months). The temporary behavioural disturbance localised around vessels is not expected to result in a substantial adverse effect on species' population, and light emissions will not seriously disrupt the lifecycle of an ecologically significant proportion any migratory birds.

Fish

Experiments using light traps have found that some fish and zooplankton species are attracted to light sources (Meekan et al., 2001), and therefore, lighting from project vessels may result in localised aggregations of fish around the vessel. Krill or plankton may also aggregate around the source of light. The concentration of organisms attracted to light may result in an increase in food source for predatory species and marine predators may subsequently aggregate in these areas (Shaw et al., 2002). The Trunkline Project Area overlaps with the whale shark BIA however, potential light disturbance is restricted to vessels during the trunkline construction phase. Presence of other threatened fish species within the Operational Area or pipeline route is expected to be of a transient nature only. Vessels undertaking trunkline installation activities will be continuously moving and present for short periods only, and are not expected to seriously disrupt the lifecycle of an ecologically significant proportion of whale sharks. Additionally, light emissions from project vessels are comparable to other activities in the region (e.g. shipping, fishing).

AMPs

The Operational Area overlaps the Montebello Marine Park, and the Dampier Marine Park is less than 1 km from the Borrow Ground Project Area. The Montebello Marine Park and Dampier Marine Park are overlapped by internesting buffer Habitat Critical to the survival of flatback, green and hawksbill turtles. As described above, there is no evidence, published or anecdotal, to suggest that internesting, mating, foraging or migrating turtles are impacted by light from offshore vessels. Although individuals undertaking 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, and therefore light emissions from project vessels are unlikely to result in displacement of, or behavioural changes to individuals during these life stages. Hence, light emissions from project vessels in the areas where the Operational Area overlaps these AMPs will not result in any impacts to internesting female turtles.

The three seabird species with BIAs overlapping the Operational Area, occupy offshore islands including the Montebello Island groups and the Dampier Archipelago. For activities occurring within the Montebello Marine Park, and adjacent to the Dampier Marine Park, the short-term and transient nature of activities associated with light emissions will not be inconsistent with the objective of the management plan for the North-west Marine Park Network.

The values identified for both these marine parks including BIAs for marine turtles, seabirds and migratory shorebirds will not be impacted given the significant distance from sensitive locations.

Summary of Assessment Outcomes				
Receptor	**Impact**	**Receptor Sensitivity Level**	**Magnitude**	**Impact Significance Level**
Ambient Light	Change in ambient light	Low value (open water)	Slight	Negligible (F)
Marine Reptiles	Change in fauna behaviour	High value species (e.g. flatback turtle)	No Lasting Effect	Slight (E)
Seabirds and Migratory Shorebirds		High value species (e.g. wedge-tailed shearwater)	No Lasting Effect	Slight (E)
AMPs	Change in fauna behaviour	High value species	Slight	Slight (E)
Overall Impact Significance Level: The overall impact significance level for routine light emissions is E based on slight, short-term impacts to the high value (marine turtles, seabirds and migratory shorebirds). The impact significance levels for individual receptors are consistent with the levels rated in the Scarborough OPP.				

Demonstration of ALARP				
Control Considered	***Control Feasibility (F) and Cost/Sacrifice (CS)***	***Benefit in Impact/Risk Reduction***	***Proportionality***	***Control Adopted***
Legislation, Codes and Standards				
No additional controls identified.				
Good Practice				
Lighting will be limited to the minimum required for navigational and safety requirements, with the exception of emergency events.	F: Yes. Lighting is typically appropriate for navigation and safety. CS: Minimal cost sacrifice – usual mode of operation.	Given the potential impacts to turtles during this activity is insignificant, implementation of this control would not result in a reduction in consequence.	While the control does not result in significant reduction of impacts, it is good practice and not at significant cost.	Yes **C 4.1**
Lighting modifications (shielding, directional lighting) to minimise over water light spill and light emissions during peak turtle hatchling season (Dec to Mar).	F: Yes, lighting is able to be modified on the PV and TSHD CS: Financial cost of changes and time associated with implementing these	Reducing light spill over water and overall light glow from a vessel can reduce the likelihood that hatchling behaviour will be influenced. Light modelling of a representative PV and TSHD has predicted that light emissions will reduce to ambient levels at 5.7 km and 4.7 km, respectively, and hence will not be at levels likely to impact turtle behaviour at nesting beaches.	Cost/sacrifice outweighs benefit. Due to the distance of key activities (pipelay and dredging) from turtle nesting beaches (>10 km, and the temporary / transient nature of this activity; benefits in implementing this control are expected to be minimal.	No

Demonstration of ALARP				
Control Considered	***Control Feasibility (F) and Cost/Sacrifice (CS)***	***Benefit in Impact/Risk Reduction***	***Proportionality***	***Control Adopted***
PV, RIV and TSHD crew will be trained in light reduction measures when operating within 20 km of turtle nesting beach, during peak hatchling season (Dec to Mar).	F: Yes. CS: Minimal cost/sacrifice.	Reducing overall light emissions from the vessel can reduce light glow and potentially lower the area over which vessel lighting may impact turtle behaviour. Given distance of the Operational Area from known turtle nesting beaches, a reduction in consequence from implementation of this control is not expected.	While the control does not result in significant reduction of potential impacts, it is good practice to raise awareness.	Yes **C 4.2**
Professional Judgement - Eliminate				
Variation of the timing of the Petroleum Activities Program within 20 km of turtle nesting beaches to avoid peak turtle hatchling emergence periods (Dec to Mar).	F: Yes. It is possible to avoid peak turtle hatchling emergence periods, through scheduling. CS: Significant cost and schedule impacts due to delays in securing vessels for specific timeframes. The Petroleum Activities Program is due to be undertaken over approx. 12 months with activities completed at various times throughout the year. To avoid peak turtle hatchling emergence periods would result in significant delays to the project.	Avoiding peak hatchling emergence periods may reduce light attraction of hatchlings. Impacts to hatchling dispersal resulting from vessel lighting are possible but will be limited by the distance of the Operational Area from the turtle nesting beaches and the temporary nature of the Petroleum Activities Program. Implementation of this control would not result in a reduction in consequence due to the distance of the Operational Areas from turtle nesting beaches and the small area impacted by vessel light glow.	The cost/sacrifice outweighs benefit gained.	No
Loading of supplies which require direction of floodlights outside vessel will not occur within 20 km of turtle nesting beaches during peak hatchling season (Dec to	F: Yes. It is possible to restrict loading from supply vessels to daylight hours CS: High cost in moving or delaying schedules around	Avoiding vessel transfer activities at night within 20 km of nesting beaches during peak hatchling season, will potentially	The cost/sacrifice outweighs benefit gained.	No

Demonstration of ALARP				
Control Considered	***Control Feasibility (F) and Cost/Sacrifice (CS)***	***Benefit in Impact/Risk Reduction***	***Proportionality***	***Control Adopted***
Mar) during hours of darkness	daylight hours. May result in lack of supplies required to carry out the activity.	reduce light spill on the ocean surface which is more apparent during darkness, therefore prevent attraction of hatchlings. Light modelling of a representative TSHD and PV has indicated that light will not be at levels likely to impact turtle behaviour at nesting beaches within 20 km of the Operational Area. Implementation of this control would not result in a reduction in consequence.		
Crew transfers which require direction of floodlights outside the vessel will preferentially occur during daylight hours, when vessels within 20 km of turtle nesting beaches during peak hatchling season(s) (Dec to Mar)	F: Yes. CS: Cost implication and delay of crew transfers.	Reducing light spill onto the water can reduce hatchling attraction to the vessel. Given distance of the Operational Area from known turtle nesting beaches, a reduction in consequence from implementation of this control is not expected.	While the control does not result in significant reduction of impacts, it is good practice and not at significant cost	Yes **C 4.3**
Turn off lighting on vessel crane(s) at night-time when not in use within 20 km of turtle nesting beaches during peak hatchling season(s) (Dec to Mar).	F: Yes. Crane lighting not required when crane is not in use. CS: Minimal cost/sacrifice.	Reducing light spill onto the water can reduce hatchling attraction to the vessel. Given distance of the Operational Area from known turtle nesting beaches, a reduction in consequence from implementation of this control is not expected.	While the control does not result in significant reduction of impacts, it is good practice and not at significant cost	Yes **C 4.4**
Professional Judgement - Substitute				
Substitute external lighting with ''turtle friendly'' light sources, (e.g. lights containing short wavelength, violet/blue light, white LEDs).	F: Yes. Replacement of some/all external lighting with turtle friendly lighting is technically feasible.	Substituting external lighting will reduce light emissions in turtles visible spectrum. Impacts to hatchling	The cost/sacrifice outweigh the benefit gained.	No

Demonstration of ALARP				
Control Considered	***Control Feasibility (F) and Cost/Sacrifice (CS)***	***Benefit in Impact/Risk Reduction***	***Proportionality***	***Control Adopted***
	CS: Financial cost and time associated with retrofitting external lighting on the vessels. Logistical effort to source sufficient inventory of the range of light types required, and to schedule works required for the vessels. Impacts to safety where lighting no longer performs it's function to the full extent intended.	dispersal resulting from vessel lighting are possible but will be limited by the distance of the Operational Area from the turtle nesting beaches and the temporary nature of the Petroleum Activities Program. Implementation of this control would not result in a reduction in consequence.		
Professional Judgement – Engineered Solutions				
PV, RIV and TSHD to use block-out blinds / curtains on accommodation windows at night when operating vessels within 20 km of turtle nesting beach during peak turtle hatchling emergence periods (Dec to Mar)	F: Yes. Installing block-out blinds / curtains is technically feasible. CS: Minimal cost/sacrifice. Accommodation modules on vessels usually have window treatments for crew comfort.	Reducing light emissions from the vessel at night can reduced light glow and the area over which light may impact turtle behaviour.	Benefits outweigh minimal cost/ sacrifice of implementation.	Yes. **C 4.5**
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 2.3.3**), Woodside considers the potential impacts from routine light emissions from the 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 Criteria and Assessment
The Petroleum Activities Program meets the acceptability criteria (**Section 2.3.5**)**:** • Overall impact significance levels for individual receptors are consistent with the levels rated in the Scarborough OPP. • EPOs and controls in the Scarborough OPP that are relevant to routine light emissions have been adopted. • There are no changes to internal/external context specific to this risk from the Scarborough OPP, including issues raised during stakeholder consultation. Following consultations with DNP on the potential risks to AMPs, the DNP noted it has no objections and claims at this time.
Acceptability Statement: The impact assessment has determined that, given the adopted controls, routine light emissions from external lighting on the project vessels is unlikely to result in an impact significance level greater than slight. BIAs for 20 EPBC Act listed Threatened or Migratory species overlap the Operational Area or EMBA. 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**).

Demonstration of acceptability for the sources of aspect and associated impacts assessed in this section are provided in Section 7.1.1.3 of the Scarborough OPP (SA0006AF0000002, rev 5) and the Demonstration of Acceptability (above) aligns with this.

The potential impacts are considered broadly acceptable if the adopted controls are implemented. Therefore, Woodside considers the adopted controls appropriate to manage the impacts of light emissions to a level that is broadly acceptable.

Environmental Performance Outcomes, Standards and Measurement Criteria			
EPO	***Adopted Control(s)***	***EPS***	***MC***
EPO 5 Undertake the Petroleum Activities Program in a manner that aims to avoid the displacement of marine turtles from important foraging habitat or from habitat critical during nesting and internesting periods. **EPO 6** Undertake the Petroleum Activities Program in a manner that will not modify, destroy, fragment, isolate or disturb an important or substantial area of habitat such that an adverse impact on marine ecosystem functioning or integrity results. **EPO 10** Undertake the Petroleum Activities Program in a manner that will not have a substantial adverse effect on a population of seabirds or shorebirds, or the spatial distribution of the population. **EPO 11** Undertake the Petroleum Activities Program in a manner that will not seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of a migratory species. **EPO 12** Undertake the Petroleum Activities Program in a manner that will not substantially modify, destroy or isolate an area of important habitat for a migratory species.	**C 4.1** Lighting will be limited to the minimum required for navigational and safety requirements, with the exception of emergency events.	**EPS 4.1** Lighting limited to that required for safe work/navigation.	**MC 4.1.1** Inspection verifies no excessive light being used beyond that required for safe work/navigation.
	C 4.2 PV, RIV and TSHD crew will be trained in light reduction measures when operating within 20 km of turtle nesting beach, during peak hatchling season (Dec to Mar).	**EPS 4.2** PV, RIV and TSHD crew trained in light reduction measures when operating within 20 km of turtle nesting beach, during peak hatchling season (Dec to Mar)	**MC 4.2.1** Crew training records
	C 4.3 Crew transfers which require direction of floodlights outside the vessel will preferentially occur during daylight hours, when vessels within 20 km of turtle nesting beaches during peak hatchling season(s) (Dec to Mar)	**EPS 4.3** Crew transfers preferentially planned for daylight hours, when vessels within 20km of turtle nesting beaches during peak hatchling season(s) (Dec to Mar).	**MC 4.3.1** Records show timing of vessel crew transfers during Dec to Mar..
	C 4.4 Turn off lighting on vessel crane(s) at night-time when not in use within 20 km of turtle nesting beaches during peak hatchling season(s) (Dec to Mar).	**EPS 4.4** During peak hatchling season(s) (Dec to Mar), when vessels are within 20 km of turtle nesting beaches, lighting on vessel crane(s) will be turned off at night-time when not in use..	**MC 4.4.1** Inspection records show lighting on vessel cranes have been turned off, when operating vessels within 20 km of turtle nesting beach during peak turtle hatchling emergence periods (Dec to Mar)
	C 4.5 PV, RIV and TSHD to use block-out blinds / curtains on accommodation windows at night when operating vessels within 20 km of turtle nesting beach during peak turtle hatchling emergence periods (Dec to Mar)	**EPS 4.5** Block out blinds available and used in accommodation quarters onboard the PV, RIV and TSHD.	**MC 4.5.1** Inspection records show block-out blinds / curtains on vessel windows have been closed at night-time, when operating vessels within 20 km of turtle nesting beach during peak turtle hatchling emergence periods (Dec to Mar)

6.6.5 Routine Atmospheric Emissions and Greenhouse Gas Emissions

Scarborough OPP – Relevant Impact Assessment Section		
Section 7.1.2 – Routine Atmospheric Emissions		
Context		
Relevant Activities Vessel Operations - **Section 3.7**	**Existing Environment** Marine Regional Characteristics – **Section 4.2** Protected Species – **Section 4.6**	**Stakeholder consultation** Consultation – **Section 5**

Impact/Risk Evaluation Summary

Source of Impact/Risk	***Environmental Value Potentially Impacted***							***Evaluation***						
	Soil and Groundwater	**Marine Sediment**	**Water Quality**	**Air Quality (inc. odour)**	**Ecosystems / Habitat**	**Species**	**Socio-economic**	**Decision Type**	**Impact/Consequence**	**Likelihood**	**Current Risk Rating**	**ALARP Tools**	**Acceptability**	**Outcome**
Internal combustion engines and incinerators on vessels				✓				A	F	-	-	LCS GP PJ	Broadly Acceptable	EPO 13,14

Description of Source of Impact/Risk

Atmospheric emissions refer to the discharges to the atmosphere of gases and particulates from an activity, or from a facility or piece of machinery, which have a recognised adverse effect on human health and/or flora and fauna. The main emissions responsible for these effects include carbon monoxide (CO), oxides of nitrogen (NOx), sulphur dioxide (SO_2), particulate matter less than 10 microns (PM10), non-methane volatile organic compounds (VOCs), BTEX (benzene, toluene, ethylbenzene and xylenes), which are specific VOCs of interest.

Greenhouse gas (GHG) emissions are defined as those gases within the atmosphere that absorb long-wave radiation, and thus trap heat reflected from the Earth's surface. The main gases responsible for this effect include carbon dioxide (CO_2), methane (CH_4) and nitrous oxide (N_2O). Other greenhouse gases include perfluorocarbons (PFCs), hydrofluorocarbons (HFCs) and sulphur hexafluoride (SF6).

Vessels are powered via the use of on-board generators (diesel-powered and/or LNG). Vessel operations require the use of marine diesel to undertake daily activities functions such as crane movements, desalination, sewage treatment, etc. Atmospheric emissions will be generated by the project vessels from internal combustion engines (including all equipment and generators) and incineration activities (including onboard incinerators).

Vessel use within the Operational Area closer to shore where townships are present is limited to the works along the trunkline route and the cycling of dredging and backfill between the Offshore Borrow Ground Project Area, Trunkline Project Area and disposal of material in Spoil Ground 5A. Works of this nature closer to shore will be conducted over a period of months (**Section 3.6**) and vessels will be continually moving. Vessel use will extend offshore within the Trunkline Project Area to a distance of approximately 375 km from the shore.

Atmospheric emissions generated during the Petroleum Activities Program will include SOx, NOx, particulates and Volatile Organic Compounds (VOCs). SOx and particulate matter emissions are heavily influenced by the fuel used and its relative sulphur content, MGO having a lower sulphite content than marine diesel oil or heavy fuel oil (HFO).

Greenhouse gases will be emitted from vessels involved in the activity consuming marine diesel fuel, and by helicopters transferring personnel. Using vessel fuel consumption rates estimated by contractors, internal helicopter fuel consumption data and emission factors from the National Greenhouse and Energy Reporting Scheme (NGERS), GHG emissions have been estimated and are presented below according to the broad project phases described in section 3:

- Pre-Lay Seabed Intervention: 25,000 tCO2e
- Trunkline Installation: 130,000 tCO2e

Post-Lay Seabed Intervention: 30,000 tCO2e

These figures are estimates only. The actual consumption of fuel varies based on factors such as the nature of activity being undertaken by vessels, metocean conditions etc. While Woodside may influence via contracting approaches, in-field day to day operations, and therefore fuel consumption, are under the control of vessel masters.

Detailed Impact Assessment

Assessment of Potential Impacts

Routine atmospheric and greenhouse gas emissions from vessel operations has the potential to result in the following impact(s):

- change in air quality

As a result of a change in air quality, further impacts may occur, which include:

- injury and/or mortality to fauna
- climate change
- change in aesthetic value.

Air Quality

Atmospheric and greenhouse gas emissions from the Petroleum Activities Program may result in a decline in local air quality, within the immediate vicinity of the emissions source. As described above, produced emissions throughout the project will include SO_2, NOx, ozone depleting substances, CO_2, particulates and VOCs. Emissions from engines, generators and deck equipment may be toxic, odoriferous or aesthetically unpleasing, and will result in a reduction in air quality.

The air quality within the Operational Area is typical of an unpolluted tropical offshore environment and the ambient air quality in the offshore NWMR will be of high quality. Atmospheric emissions from the fuel combustion and incineration on project vessels (including generation of dark smoke) have the potential to result in a localised reduction in air quality in the immediate vicinity of the release point, with no lasting effect.

Although the Offshore Borrow Ground Project Area and part of the Trunkline Project Area are located closer to the shore, they remain in open ocean and well-removed from nearest residential or sensitive populations of the WA coast. Given the short duration and exposed location of project vessels, low volumes of atmospheric emissions will be rapidly dispersed, therefore biodiversity, ecological integrity, social amenities and human health will not be impacted.

Marine Fauna

Atmospheric emissions can cause direct impacts to fauna if they are present in the immediate vicinity of significant releases. Birds, for example, have been shown to suffer respiratory distress and illness when subjected to extended duration exposure to air pollutants (Sanderfoot and Holloway, 2017). Given that atmospheric emissions from project vessels will be transient and temporary, and that fauna numbers will be low at the point of discharge, injury or mortality to fauna a result of atmospheric discharges is considered negligible and has not been evaluated further.

Climate Change

GHG emissions generated by vessels contribute to global concentrations of GHG emissions. Climate change impacts cannot be directly attributed to any one activity, as they are instead the result of global GHG emission, minus global GHG sinks, that have accumulated in the atmosphere since the industrial revolution. The assessment of the Scarborough Project, including the contribution to global GHG emissions and the potential impacts of climate change on sensitive receptors, within Australian jurisdictions is described in Section 7.1.3 of the Scarborough OPP (SA0006AF0000002, rev 5). The Petroleum Activities Program GHG emissions, combined with other Scarborough Project construction, installation and decommissioning related GHG emissions, were estimated to be less than 1% of total project lifecycle emissions, as described in the Scarborough OPP Section 7.1.3.2 (SA0006AF0000002, rev 5). Other construction, installation and decommissioning GHG emissions will be addressed in relevant EP for those activities.

Aesthetic Value

Atmospheric emissions have the potential to introduce odour and visual amenity issues which can result in changes to the aesthetic value of an area. Scarborough is located in the open ocean and is well-removed from nearest residential or sensitive populations of the WA coast, with limited interaction with the regional airshed. Although the Offshore Borrow Ground Project Area and part of the Trunkline Project Area are located closer to the shore, they remain in open ocean and the potential for a change in air quality from atmospheric emissions associated with Scarborough resulting in a change to aesthetic value for tourism/recreation or settlements is not considered to be credible.

Summary of Assessment Outcomes

Receptor	Impact	Receptor Sensitivity Level	Magnitude	Impact Significance Level / Risk Consequence
Air Quality	Change in air quality	Low value (open water)	Slight	Negligible (F)

	Climate Change	Low value	Slight	Negligible (F)

Overall Impact Significance Level: The overall impact significance level for routine atmospheric and GHG emissions is negligible (F) based on a slight effect on air quality. The impact significance levels for individual receptors are consistent with the levels rated in the Scarborough OPP.

Demonstration of ALARP				
Control Considered	***Control Feasibility (F) and Cost/Sacrifice (CS)***	***Benefit in Impact/Risk Reduction***	***Proportionality***	***Control Adopted***
Legislation, Codes and Standards				
Vessel compliance with Marine Order 97 (Marine pollution prevention – Air pollution).	F: Yes. CS: Minimal cost. Standard practice	Legislative requirements to be followed may slightly reduce the likelihood of air pollution.	Control based on legislative requirements – must be adopted.	Yes **C 5.1**
Reporting of GHG emissions as required by regulatory requirements	F: Yes. CS: Minimal cost. Standard practice	Emissions reporting can increase transparency and accountability	Control based on regulatory requirements – must be adopted.	Yes **C 5.2**
Good Practice				
Vessel operations planned such that fuel consumption and therefore subsequent emissions are minimised. Examples may include such aspects as vessel speeds, cleaning of biofouling, preventative maintenance on equipment such as thrusters, or turning off equipment when not in use.	F: Yes CS: Schedule delays	Managing use of PAP vessel can reduce fuel usage and subsequent GHG / air emissions	Potential benefit outweighs cost/sacrifice.	Yes **C 5.3**
Professional Judgement - Eliminate				
Do not combust fuel.	F: No. There are no vessels that do not use internal combustion engines. CS: Not considered – control not feasible.	Not considered – control not feasible.	Not considered – control not feasible.	No
Professional Judgement - Substitute				
Fuels types selected to reduce expected GHG emissions.	F: Yes CS: Monetary cost of fuel, logistics associated with fuel type supply (esp. wrt international vessels) and fuel inventory management for international vessels which may be required to change fuel type	Alternative fuel types such as Marine Gas Oil and Marine Diesel Oil (MGO & MDO) can reduce GHG emissions during use when compared to heavy or intermediate fuel oils (HFO or IFO)	Potential benefit outweighs cost/sacrifice.	Yes **C 5.4**
Predominantly use DP Bulk Carriers (B-Types) for pipe	F: Yes CS: Time in designing and building the B-type	Increasing efficiency of pipe transfer activities can reduce fuel usage and	Potential benefits outweigh cost / sacrifice	Yes **C 5.5**

Demonstration of ALARP				
Control Considered	***Control Feasibility (F) and Cost/Sacrifice (CS)***	***Benefit in Impact/Risk Reduction***	***Proportionality***	***Control Adopted***
supply vessels servicing the PV	vessels and technical risk associated with new-build vessels	subsequent GHG / air emissions		
Professional Judgement – Engineered Solutions				
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 2.3.3**), Woodside considers the adopted controls are considered good oil-field practice/industry best practice, and appropriate to manage the impacts of fuel combustion and incineration. As no reasonable additional/alternative controls were identified that would further reduce the impacts without grossly disproportionate sacrifice, the impacts are considered ALARP.

Demonstration of Acceptability

Acceptability Criteria and Assessment

The Petroleum Activities Program meets the acceptability criteria (**Section 2.3.5**):

- Overall impact significance levels for individual receptors are consistent with the levels rated in the Scarborough OPP.
- EPOs and controls in the Scarborough OPP that are relevant to GHG emissions have been adopted.
- There are no changes to internal/external context specific to this risk from the Scarborough OPP, including issues raised during stakeholder consultation.

Acceptability Statement:

The impact assessment has determined that, given the adopted controls, routine atmospheric emissions from fuel combustion and incineration are unlikely to result in an impact significance greater than negligible. The adopted controls are considered consistent with industry legislation, codes and standards, and professional judgement and meet the requirements of Australian Marine Orders.

The potential impacts are considered broadly acceptable if the adopted controls are implemented. Therefore, Woodside considers the adopted controls appropriate to manage the impacts of routine atmospheric and GHG emissions to a level that is broadly acceptable.

Environmental Performance Outcomes, Standards and Measurement Criteria

EPO	***Adopted Control(s)***	***EPS***	***MC***
EPO 13 Undertake the Petroleum Activities Program in a manner that will not result in a substantial change in air quality which may adversely impact on biodiversity, ecological integrity social amenity or human health. **EPO 14** Optimise efficiencies in air emissions and reduce GHG emissions to ALARP and acceptable levels.	**C 5.1** Vessel compliance with Marine Order 97 (Marine Pollution Prevention – Air Pollution) including: • International Air Pollution Prevention (IAPP) Certificate, required by vessel class • Use of low sulphur fuel when available Ship Energy Efficiency Management Plan (SEEMP), where required by vessel class	**PS 5.1** Vessels compliant with Marine Order 97 (Marine Pollution Prevention – Air Pollution) to restrict emissions to those necessary to perform the activity.	**MC 5.1.1** Marine assurance inspection records demonstrate compliance with Marine Order 97.

Environmental Performance Outcomes, Standards and Measurement Criteria			
EPO	***Adopted Control(s)***	***EPS***	***MC***
	• Onboard incinerator to comply with Marine Order 97.		
	C 5.2 Reporting of GHG emissions as required by regulatory requirements.	**PS 5.2** GHG emissions reported as per regulatory requirements.	**MC 5.2.1** GHG emissions records demonstrate reporting undertaken as per regulatory requirements.
	C 5.3 Vessel operations will be planned such that fuel consumption is minimised where practicable. Examples may include such aspects as vessel speeds, cleaning of biofouling, preventative maintenance on equipment such as thrusters, or turning off equipment when not in use.	**PS 5.3.1** Vessel operations planned, where practicable, to minimise fuel consumption and associated GHG/air emissions	**MC 5.3.1** Plan/records show fuel use/emissions have been considered in vessel operations
		PS 5.3.2 Relevant vessel crew aware of requirement to consider GHG/air emissions in vessel operations.	**MC 5.3.2** Awareness training records include information on consideration of fuel use/GHG emissions for vessel operations.
	C 5.4 Fuels types selected to reduce expected GHG emissions.	**PS 5.4** Project vessels will not use heavy fuel oil (HFO) or intermediate fuel oil (IFO)	**MC 5.4.1** Records show vessels operating in the PAP use alternative fuels to HFO / IFO
	C 5.5 Predominantly use DP Bulk Carriers (B-Types) for pipe supply vessels servicing the PV	**PS 5.5** DP Bulk Carriers (B-Types) predominantly used for pipe supply to the PV.	**MC 5.5.1** Records show DP Bulk Carriers predominantly used to supply pipe to PV

6.6.6 Routine Acoustic Emissions

Scarborough OPP – Relevant Impact Assessment Section		
Section 7.1.4 – Routine Acoustic Emissions		
Context		
Relevant Activities Vessel Operations – **Section 3.7** Helicopter Operations – **Section 3.8.2** Seabed Intervention Activities – **Section 3.9** Trunkline Installation Activities- **Section 3.11**	**Existing Environment** Marine Regional Characteristics – **Section 4.2** Protected Species – **Section 4.6**	**Stakeholder consultation** Consultation – **Section 5** .

Impact/Risk Evaluation Summary

Source of Impact/Risk	***Environmental Value Potentially Impacted***							***Evaluation***						
	Soil and Groundwater	**Marine Sediment**	**Water Quality**	**Air Quality (inc. odour)**	**Ecosystems / Habitat**	**Species**	**Socio-economic**	**Decision Type**	**Impact/Consequence**	**Likelihood**	**Current Risk Rating**	**ALARP Tools**	**Acceptability**	**Outcome**
Generation of acoustic signals from geophysical sources during surveys						✓		A	E	-	-	PJ	Broadly Acceptable	EPO 6,11,15
Generation of acoustic signals from positioning equipment (transponders)						✓								
Generation of acoustic signals from DP systems on vessels						✓								
Generation of acoustic signals during seabed intervention and pipelay activities.						✓								
Generation of acoustic signals from helicopters						✓								

Description of Source of Impact/Risk

The Petroleum Activities Program may not be executed as a single campaign or in a consecutive sequence, therefore acoustic emissions may occur within the Trunkline Project Area at any time during the period of the EP.

Geophysical and Geotechnical Pre-lay Survey Activities

The noise emitted during geotechnical survey activities is generated by a combination of the geotechnical equipment (sampling and in situ testing operations) and the survey vessel (described below).

Geophysical and geotechnical survey activities may occur within the Trunkline Project Area and Borrow Ground Project Area. Geophysical sources will be used for bathymetric mapping and shallow sub-bottom profiling, penetrating to depths of about 20 m below the seabed. A range of geophysical sources will emit pulses (impulsive noise) with frequency outputs ranging from 10 Hz (low end of refraction system) to 900 kHz (side scan sonar).

The survey methods may include:

- multibeam echo sounders (MBES)
- side scan sonar (SSS)
- pipe trackers
- magneto meter and sub bottom profiler (SBP)

Sound pressure levels (SPL) for MBES typically range from 210 to 245 dB re 1 µPa @ 1 m, and SSS typically range from 200–235 dB re 1µPa SPL (Jimenez-Arranz et al., 2020). The frequencies range from about 75 to 900 kHz (Jimenez-Arranz et al., 2020).

Underwater Positioning Equipment

An array of long baseline (LBL) and/or ultra-short baseline (USBL) transponders may be installed on the seabed for positioning of mattresses, rock berms or structures on the seabed.

Transponders typically emit pulses (impulsive noise) of medium frequency sound, generally within the range 21 to 31 kHz. The estimated SPL would be 180 to 206 dB re 1 µPa at 1 m (Jiménez-Arranz et al., 2020). Transmissions are not continuous but consist of short 'chirps' with a duration that ranges from 3 to 40 milliseconds. Transponders will not emit any sound when on standby, and when required for precise positioning they will emit one chirp every five seconds (estimated to be required for four hours at a time).

Vessel Operations

Vessels used for the Petroleum Activities Program are detailed in **Section 3**. The sound levels and frequencies generated by vessels varies with the size of the vessel, speed, engine type and the activity being undertaken. Large vessels typically produce higher sound levels at lower frequencies than small vessels, although significant variation may be found among vessels within the same group (Jiménez-Arranz et al., 2020). Sound levels tend to be greatest when engaging the throttle or thrusters, such as use of DP or when vessels are operating under load, compared with slow moving or idling vessels (Salgado Kent et al. 2016).

The greatest sound levels are likely to be associated with vessels using DP thrusters to maintain position on station. For example, the TSHD and deepwater PV will operate on DP and support and supply vessels may also engage thrusters when working alongside. McCauley (1998) measured underwater broadband noise equivalent to approximately 182 dB re 1 µPa at 1 m (rms SPL) from a support vessel holding station using DP in the Timor Sea; it is expected that similar noise levels will be generated by vessels used for this Petroleum Activities Program. Similarly, Hannay et al. (2004) and McCauley (2005) have measured source level for support vessel with DP of 186 dB re 1 µPa at 1 m (**Table 6-9**)***.*** Pipelay vessels operating DP have been reported to have source levels between approximately 168 and 187 dB re 1 µPa at 1 m (SPL) (Nedwell and Edwards, 2004; MacGillivray and Racca, 2006; Johansson and Andersson, 2012; Jiménez-Arranz et al., 2020).

Acoustic emissions from the PV Castorone, which will be used for the Petroleum Activities Program has been estimated to have a source level of 192 dB 1 µPa based on measurements from a similar surrogate PV (Zykov et al., 2013).

Excluding DP, vessels produce low frequency sound (i.e. below 1 kHz) from the operation of machinery, hydrodynamic flow sound around the hull and from propeller cavitation.

Seabed Intervention and Pipelay

<u>TSHD</u>

In addition to acoustic emissions from DP, TSHD activities will generate sound from sediment excavation and placement of the dredged material at the disposal site (**Figure 6-3**). However, sources of acoustic emissions are most likely to be associated with cavitation noise from TSHD propellers and bow thrusters (de Jong et al., 2010), rather than other sources associated with TSHD (drag head).

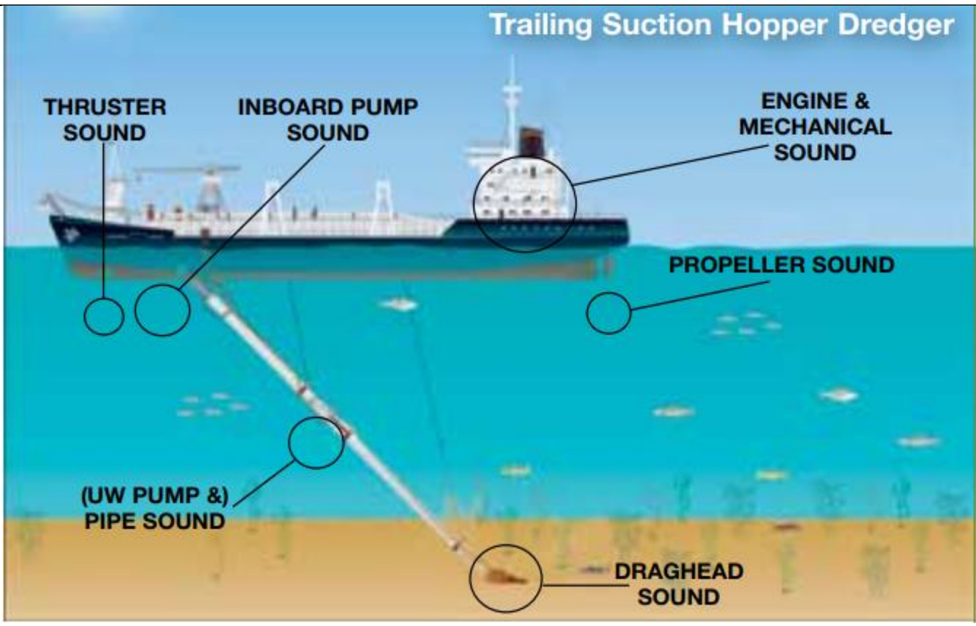


Figure 6-3: Sound sources for TSHD (WODA, 2013)

Acoustic emissions produced by TSHDs has been measured on a number of occasions, as documented in CEDA (2011). Robinson et al. (2011) measured six TSHDs, stating that sound levels below 500 Hz were in line with those expected for a cargo ship travelling at modest speeds (8 –16 knots). The maximum broadband source sound pressure level (SPL) was 189.9 dB re 1 µPa at 1 m (calculated based on 1/3 octave band levels from 31.6 Hz to 39.8 kHz, (Robinson et al., 2011) (**Table 6-9**). De Jong et al. (2010) measured underwater sounds produced by seven TSHDs. Results showed that dredging itself did not produce louder sounds than those produced by the dredger during transit between the dredging and placement sites (**Figure 6-4**). The TSHDs had an estimated maximum SPL around 184 – 188 dB re 1 µPa^2 m^2 (main energy between 100 and 500 Hz).

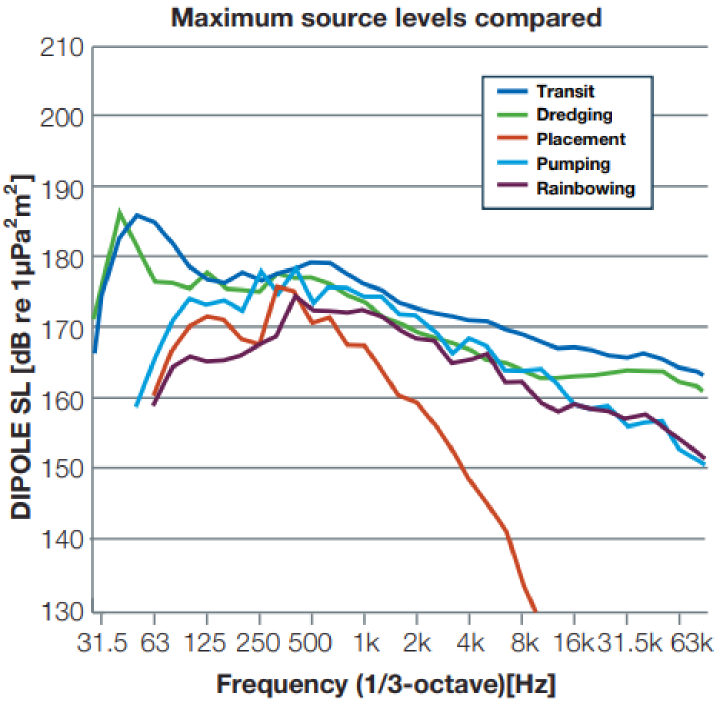


Figure 6-4: Comparison of the upper envelope of the measured dipole source level spectra for seven TSHDs, while transiting, dredging, placement, pumping and rainbowing (de Jong et al. 2010, cited in WODA, 2013)

<u>Slope Crossing Seabed Preparation</u>

A construction vessel, equipped with an ROV controlled heavy duty grab, is planned to be used for slope crossing seabed preparation. The noise produced by grab excavation vary substantially with operational stage. Dickerson et al.

(2001) measured SPLs at 0.15 km from a grab dredger. The loudest SPLs of 124 dB re 1 µPa were recorded at peak frequencies of 0.16 kHz, when the bucket made impact with the seabed. However, sound levels during this operation will be highly dependent on the material dredged (sand as opposed to gravel) (Robinson et al., 2011). Another investigation carried out on grab dredgers indicates that the activity is relatively quiet and recorded sound levels were just above the background sound at approximately 1 km from the source (Clarke et al., 2002).

Secondary options to achieve the excavation profile are methods such as mass flow excavation, conventional ROV dredging tooling and/or jetting to create the required trench. Acoustic emissions generated from these activities are expected to be similar to the ROV grab or TSHD described above.

Pipelay and Rock Placement

During installation of the trunkline, pipelaying is unlikely to have a noticeable contribution to the sound field as the largest contribution comes instead from the vessel DP, supply vessels and tugs (Johanson and Andersson 2012; Jiménez-Arranz et al., 2020). Similarly, when comparing the sound levels produced during rock placement and normal operations by a pipelay vessel there was no noticeable increase in noise, which again suggests that sound levels are dominated by vessel noise (Nedwell and Edwards 2004; Jiménez-Arranz et al., 2020).

Helicopter Operations

Helicopter noise is emitted to the atmosphere during routine helicopter flights to support operations (**Section 3.8.2**). Sound emitted from helicopter operations is typically below 500 Hz (Richardson et al., 1985). 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).

Table 6-9: Sources of aspect, and the operating frequency and noise levels

Source of aspect	Operating frequency (kHz)	Source Level (@1 m)		Sound category	Reference
		SPL (L_p)	***PK (L_{pk})***		
Pre-lay surveys	0.07-9	210-245	-	Impulsive	Jimenez-Arranz et al. (2020)
TSHD	0.3-20	186 -188	-	Continuous	Thomsen et al. (2009) Robinson et al. (2011) CEDA (2011) WODA (2013)
Positioning equipment	21-31	180-206	-	Impulsive	Jimenez-Arranz et al. (2020)
Vessel operations (DP)	0.2-1	182-186	-	Continuous	McCauley (1998, 2005) Hannay (2004)
Helicopter operations	0.5	162	-	Continuous	Simmonds et al. (2004)

Detailed Impact Assessment

Assessment of Potential Impacts

Routine acoustic emissions from the sources described above have the potential to result in the following impact(s):

- a change in ambient noise
- a change in fauna behaviour
- injury and/or mortality to fauna.
- changes to the functions, interest or activities of other users.

Potential Impact of Noise

Elevated underwater noise can affect marine fauna, including cetaceans, marine turtles, fish, 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.

The extent of the impacts of underwater noise on marine fauna will depend upon the frequency range and intensity of the noise produced, and the type of acoustic signal.

<u>Sound Propagation</u>

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.

Ambient Noise

Ambient noise levels in the Operational Area may be elevated during the Petroleum Activities Program. Underwater noise surveys in the region detected marine fauna vocalisations and anthropogenic sources including vessel noise; seismic survey signals; mooring noise artefacts (McCauley, 2011). Although ambient noise levels in the Operational Area have not been recorded, they are expected to be similar to published ambient noise levels. The Operational Area (Trunkline Route KP 32 to KP 50 and Offshore Borrow Ground) closer to shore where the TSHD vessel will be used are in proximity to existing ports, and a small portion of the Trunkline Project Area also overlaps the Pilbara Port Authority Management Area. These areas are already anticipated to receive anthropogenic sources of noise. Therefore routine acoustic emissions will result in a small incremental increase in ambient noise with no lasting effect.

Sound source characterisation

Woodside commissioned DNV (noise and vibration section) to predict the expected source levels from a number of different vessels whilst on DP, including the PV Castorone, a Saipem B-Type bulk carrier (referred to as B-Type henceforth) and a representative supply vessel (OSV). The noise levels were predicted for each propeller of each thruster on the vessels, and for a specified set of operating conditions. These predictions are based on semi-empirical DNV models, utilizing data from full scale measurements at sea. The DNV modelling predicted a combined, estimated broadband energy source level (ESL) of 189.8 dB re 1 μPa^2 m^2 s for the PV, based on a thruster utilisation of 50%, which has been determined to be appropriate for DP requirements during pipelay, and the prevailing metocean conditions expected during the Petroleum Activities Program. The DNV modelling predicted a combined, estimated broadband ESL for the B-Type of 185.7 dB re 1 μPa^2 m^2 s. Note that these ESLs were not used in the modelling, but are provided for reference only. Thruster noise from the PV was modelled for each thruster separately as nine point sources at depths of 1.8, 6.1, and 11.8 m. Thruster noise from the B-Type was modelled for each of thruster separately as six point sources at depths of 6.7, 7.2, and 6.9 m (Connell et al., 2021).

Acoustic Modelling

To assess the potential magnitude and extent of impacts from underwater noise produced during the Petroleum Activities Program, Woodside commissioned JASCO Applied Sciences (JASCO) to model sound propagation for a range of vessel scenarios during pipelay activities. This modelling study (Connell et al., 2021) considered specific components of the Petroleum Activities Program for representative scenarios within the pygmy blue whale (PBW) migration BIA. Three types of vessels were identified and used to model four sources: the PV undertaking pipelay operations; a B-Type vessel either performing resupply alongside the PV or bunkering alongside a tanker under DP; and an OSV under DP alongside the PV. These four sources are considered in different combinations for a total of twelve scenarios, including step away scenarios where the B-Type bunkering location was progressively moved farther from the other vessels.

The modelling study specifically assessed distances from operations where underwater sound levels reached thresholds corresponding to behavioural response, impairment (TTS) and injury (PTS). The animals considered here included low-frequency (LF), high-frequency (HF), and very high-frequency (VHF) cetaceans, turtles, and fish including fish larvae and eggs.

The modelling methodology considered the source levels of the individual thrusters for the PV, B-Type, and OSV, as well as environmental properties that effect sound propagation. Estimated underwater acoustic levels are presented as sound pressure levels (SPL), and accumulated sound exposure levels (SEL) as appropriate for non-impulsive (continuous) noise sources. In this study, the duration of the SEL accumulation was defined as integrated over a 24-hour period.

The four sources are considered in different combinations along the pipelay track across the PBW migration BIA, for a total of twelve scenarios, six of which were also considered with animat modelling. Five of these scenarios are the B-Type vessel bunkering in isolation at increasing distances (“stepped away”) from the PV. These five scenarios are added to normal operations with the PV to determine any overlap with marine mammal noise effect thresholds.

Animal movement and exposure modelling (ANIMAT modelling)

In addition to the acoustic modelling outlined above, Woodside commissioned JASCO to also perform an acoustic exposure analysis study for PBW within the migration BIA to investigate any potential effects on PBW migration from the Petroleum Activities Program, using the JASCO Animal Simulation Model Including Noise Exposure (JASMINE).

Sound exposure distribution estimates were determined by moving large numbers of simulated animals (animats) through a modelled time-evolving sound field, computed using the predicted sound source levels and sound propagation modelling outputs. This approach provides the most realistic prediction of the maximum expected root-mean-square

SPL and the temporal accumulation of SEL that are considered the most relevant sound metrics for impact assessment. For , the moving receivers (the animats) were set to simulate the real-world movements of migrating pygmy blue whales in a southbound direction. Animal movement modelling was considered for the subset of acoustic modelling scenarios that included "normal operations" (PV, B-type, and OSV under DP) and B-type bunkering at various step away distances. The distribution of distances of animats predicted to be exposed to sound levels above threshold was used to calculate the 95th percentile exposure range ($ER_{95\%}$), and noise effect metrics included SEL_{24h} and SPL (Connell et al., 2021).

Marine Mammals

Eleven cetacean species may be present within the Operational Area, including LF cetaceans such as humpback whales and pygmy blue whales, and HF cetaceans including Indo-Pacific and spotted bottlenose dolphins (**Section 4.6.3**). The following species have BIAs (**Section 4.6.3**) that intercept Operational Area:

- Pygmy blue whale - migration BIA occurs in deeper waters of the Trunkline Project Area.
- Humpback whale - migration BIA occurs in the nearshore waters of Trunkline Project Area and the Offshore Borrow Ground Project Area.

Species Sensitivity and Thresholds

Marine mammals and especially cetaceans rely on sound for important life functions including individual recognition, socialising, detecting predators and prey, navigation and reproduction (Weilgart, 2007; Erbe et al., 2015; Erbe et al., 2018). Underwater noise can affect marine mammals in various ways including interfering with communication (masking), behavioural changes, a shift in the hearing threshold; permanent threshold shift (PTS) and temporary threshold shift (TTS), physical damage and stress (NRC, 2003; Erbe, 2012; Rolland et al., 2012). There is little information available regarding call masking in whales (Richardson et al., 1995), although it has been suggested that an observed lengthening of calls in response to low-frequency noise in humpback whales and orcas may be a response to auditory masking (Fristrup et al., 2003; Foote et al., 2004). Exposure to intense impulsive noise may be more hazardous to hearing than continuous noise.

The thresholds that could result in a behavioural response, TTS and PTS for cetaceans as a result of impulsive and continuous noise sources are outlined in **Table 6-10**. These thresholds have been adopted by the United States National Oceanic and Atmospheric Administration (NOAA) (National Marine Fisheries Service [NMFS], 2014, 2018; Southall et al., 2019; NOAA, 2019).

Table 6-10: Thresholds for PTS, TTS and behavioural response onset in low-frequency (LF) and high-frequency (HF) cetaceans for impulsive and continuous noise

Hearing group	Impulsive			Continuous		
	PTS onset thresholds: SEL_{24h} (dB re 1 µPa².s)	TTS onset thresholds: SEL_{24h} (dB re 1 µPa².s)	Behavioural response (dB re 1 µPa)	PTS onset thresholds: SEL_{24h} (dB re 1 µPa².s)	TTS onset thresholds: SEL_{24h} (dB re 1 µPa².s)	Behavioural response (dB re 1 µPa)
LF cetaceans	183	168	160	199	179	120
HF cetaceans	185	170		198	178	

Source: NMFS (2014, 2018; Southall, 2019; NOAA, 2019).

Acoustic emissions during pipelay activities are likely to have the greatest impact to marine fauna, given the estimated source levels for the PV (~190-192 dB re 1 µPa^2 m^2 s) and the duration of the pipelay activity. Pipelay will also cross the PBW migration BIA. Pygmy blue whales migrate as solitary animals or in small groups along the continental slope, typically at depths between 500 m and 1000 m on the way to the Banda and Molucca seas near Indonesia, where calving is understood to occur (Double et al., 2014). The northern migration typically passes north-western Australia between approximately April to July with the return southern migration between October and January.

Results – Acoustic Modelling

Modelling of sound propagation loss for the PV on DP (Scenario 1), in the Trunkline Project Area at a location within the PBW migration BIA, predicted that noise levels would drop below 120 dB re 1 µPa (behavioural response threshold for continuous noise sources; **Table 6-10**) within 14.5 km (**Table 6-11**). The modelling also estimated propagation of combined noise from the PV during pipelay, along with B-Type and OSV alongside, both operating on DP ("normal operations" - Scenario 2). The modelling predicted combined noise levels from all three vessels would drop below 120 dB within 15.7 km. The maximum distance to the behavioural response threshold was 16.5 km (for Scenario 4 - normal operations + B-Type Bunkering at step away location 1). The modelling determined that for there to be no overlap of behavioural response zones for LF cetaceans (i.e. the 120 dB isopleths) between the normal operations and the B-Type bunkering, there needs to be 25 km of separation between two operations (Connell et al., 2021).

Considering the NMFS (2018) SEL_{24h} threshold criteria for LF cetaceans (179 dB re 1 µPa².s), TTS onset could occur within 0.9 km from the PV on DP (Scenario 1) or 1.26 km from the combination of vessels (Scenario 2) (Connell et al., 2021). For LF cetaceans, the maximum distance to the PTS onset threshold was 150 m for all scenarios. The maximum distance to TTS onset threshold was 1.32 km (**Table 6-11**).

For HF cetaceans, TTS onset could occur within 150 m for both Scenario 1 and 2. PTS threshold for HF cetaceans was not reached within the limits of the modelled resolution (20 m) for any scenario modelled.

Table 6-11: Maximum predicted horizontal distances (R_{max}) to PTS, TTS and behavioural response thresholds in cetaceans, for all 12 scenarios

Hearing group	Sound exposure threshold	R_{max} distance (km)
PTS		
LF cetaceans	199 dB re 1 µPa².s (SEL_{24h})	0.15
HF cetaceans	198 dB re 1 µPa².s (SEL_{24h})	-
TTS		
LF cetaceans	179 dB re 1 µPa².s (SEL_{24h})	1.32
HF cetaceans	178 dB re 1 µPa².s (SEL_{24h})	0.15
Behavioural response		
LF cetaceans	120 dB re 1 µPa (SPL)	16.5
HF cetaceans		

A dash indicates the level was not reached within the limits of the modelled resolution (20 m).

The Blue Whale Conservation Management Plan (Action Area 2) states that anthropogenic noise in BIAs should be managed such that any blue whale continues to utilise the area without injury (Commonwealth of Australia, 2015a). Although TTS in cetaceans has previously been regarded as hearing impairment, not injury, advice from NOPSEMA and DAWE is that TTS should be considered a form of injury to pygmy blue whales and this should be prevented within the BIAs. However, PTS and TTS criteria exceedances are based upon exposure for 24-hours by a stationary receptor, which is not a realistic scenario. The SEL_{24h} criterion is a cumulative metric that reflects the dosimetric impact of sound energy accumulated over a 24-hour period and assumes that an animal is consistently exposed to such noise levels at a fixed location. The radii that correspond to SEL_{24h} therefore represent an unlikely worst-case scenario for SEL-based exposure since, more realistically, marine fauna would not stay in the same location or at the same range for 24-hours (Connell et al., 2021). PTS and TTS thresholds are unlikely to be exceeded for cetaceans transiting through the Operational Area.

Whilst the Trunkline Project Area overlaps part of the pygmy blue whale migration BIA, there is no overlap with known or possible foraging areas for the species, as defined in the Blue Whale Conservation Management Plan (CMP). In September 2021, the Department of Agriculture, Water and the Environment (DAWE) published guidance on key terms within the CMP, which provided a definition of 'a foraging area' and noted the potential for opportunistic foraging and feeding to occur outside these designated foraging areas. Pygmy blue whales may engage in opportunistic foraging during both northbound and southbound migrations, so there is the potential for this activity to occur in the Trunkline Project area, particularly where it overlaps the migration BIA.

Results - JASMINE

The results of the animal movement modelling predicted that between 11 and 88% of animats within $ER_{95\%}$ would be exposed above threshold. As expected, $ER_{95\%}$ for the SEL_{24h} metric was shorter than the predicted range for static receivers, because of the shorter dwell time of the moving animats. The maximum $ER_{95\%}$ to SEL_{24h} thresholds was 0.03 km for TTS and 0.01 km for PTS. Single-exposure metrics, such as SPL, are not sensitive to changes in dwell time, but rather the distribution of noise within the water column and the use of the water column by the animat, and therefore $ER_{95\%}$ tends to be comparable to that predicted by acoustic propagation modelling. The $ER_{95\%}$ to the behavioural response SPL threshold ranged from 12.77 to 13.28 km. There was no significant variation in exposure range between the six modelled scenarios.

Table 6-12: Summary of animat simulation results for migrating pygmy blue whales indicating the maximum of the 95th percentile exposure ranges (in km) over all scenarios. The maximum probability of animats being exposed above threshold within the $ER_{95\%}$ is also provided for all modelled scenarios

Threshold			$ER_{95\%}$		Scenario #	Scenario description
Description		Threshold level (dB)	Distance (km)	Probability of exposure (%)		
TTS	SEL_{24h}	179[1]	0.03	88	2	Normal operations – PV, B-Type, and OSV all under DP
PTS	SEL_{24h}	199[1]	0.01	11	2	

Behavioural response	120[2]	13.28	77	4	Normal operations + B-Type bunkering at step away location 1

[1] LF-weighted SEL_{24h} (L_E,24h; dB re 1 µPa^2 ·s)
[2] SPL (Lp; dB re 1 µPa)

The pygmy blue whale BIA also overlaps the location of slope crossing seabed preparation, which requires vessel use and excavation. Higher sound levels have been observed when a grab bucket makes impact with the seabed (Dickerson et al., 2001), however and noise levels are largely dependent on the seabed substrate. Given that the seabed material along that section of the trunkline is sand/soft sediment (**Section 4.4.3**), significant noise emissions during the grab operations are not anticipated.

Humpback whales are expected to be encountered during the trenching and material disposal and offshore borrow ground dredging and backfill, particularly should these activities occur during annual migrations (July (northbound) and late August/September (southbound)). CEDA (2011) notes the scarcity of studies quantifying noise impacts from dredging, and any documented effects have been limited to behavioural. As noted in **Figure 6-4**, elevated acoustic emissions do occur during dredging, however these are not expected to impact marine mammals any greater than acoustic emissions from transiting vessels (de Jong et al., 2010) and will be within the modelled acoustic footprint of vessel operations during pipelay described above. PTS and TTS impacts are therefore considered highly unlikely. Behavioural response may result in a deviation in course during migration, which is expected to be insignificant in the context of the long distances over which individuals migrate (thousands of kilometres). Marine mammals that are frequently exposed to sounds such as vessel noise may also habituate and adapt to this noise (Richardson et al. 1995; NRCC, 2003). This may be the case for the humpback whale population that regularly passes through areas of significant shipping traffic during the migration

The very high-frequency micro-pulses of sound produced by MBES and SSS during seabed surveys rapidly attenuate outside of the beam (MacGillivray et al., 2013; Zykov, 2013). The high operating frequencies of these instruments also places the majority of sound frequencies above the auditory range of most marine fauna species. Dolphins and other mid-frequency cetaceans, which have peak hearing sensitivity up to 110 kHz, with potential for some limited hearing ability up to approximately 160 kHz (NMFS 2018), may be able to detect a small amount of the sound energy from some survey instruments in the lower operating frequency ranges (MacGillivray et al., 2013; Zykov, 2013). The propagation of the high frequency sound from MBES and SSS has been undertaken by Zykov (2013) and MacGillivray et al. (2013). The modelling results indicate that the sound emissions outside of the main beams are below the threshold levels for potential injury, PTS or TTS. Sound levels that may result in behavioural effects are likely limited to within tens of metres, but potentially up to a few hundreds of metres from the sound source for some mid-frequency cetaceans such as dolphins (Zykov, 2013; MacGillivray et al., 2013). Varghese et al. (2020) recently studied the foraging behaviours and vocalisations of beaked whales (mid-frequency cetaceans) to 12 kHz MBES surveys and concluded there was not a consistent change in foraging behaviour during the MBES surveys that would suggest a clear response. The animals did not leave the area nor stop foraging during MBES activity. Geophysical survey activities are therefore expected to result in temporary behavioural effects to marine mammals within tens or hundreds of metres from the survey activities. Such localised effects are smaller than those expected from the vessels and are not expected to be biologically significant.

Based on the above assessment, potential impacts to cetaceans from routine acoustic emissions are expected to be limited to behavioural impacts within a localised area around the project vessels, with no lasting effect.

Marine Reptiles

Five species of marine turtle may occur in the Operational Area: flatback, green, hawksbill, loggerhead and leatherback turtles. The Operational Area overlap internesting Habitat Critical and internesting buffer BIAs for the flatback, green and hawksbill turtle around the Dampier Archipelago and Montebello Islands (**Section 4.6.2**).

Species Sensitivity and Thresholds

There is a paucity of data regarding responses of marine turtles to continuous underwater noise. However, 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). Lenhardt (1994) observed marine turtles avoiding low-frequency sound.

Acute noise, or temporary exposure to loud noise, may result in the avoidance of important habitats and in some situations physical damage to marine turtles. McCauley et al. (2000) observed the behavioural response of caged sea turtles—green (*Chelonia mydas*) and loggerhead (*Caretta caretta*)—to an approaching seismic airgun. For received levels above 166 dB re 1 µPa (SPL), the turtles increased their swimming activity and above 175 dB re 1 µPa (SPL) they began to behave erratically, which was interpreted as an agitated state.

The sound exposure thresholds for marine turtles are summarised in **Table 6-13** below. No numerical thresholds have been developed for impacts of continuous sources (e.g. vessel noise) on marine turtles. A Popper et al. (2014) review assessed thresholds for marine turtles and found qualitative results that the risk of TTS was moderate for near field exposure, and low for both intermediate and far field exposure (Popper et al., 2014).

Table 6-13: Thresholds for PTS, TTS and behavioural response onset in marine turtles for impulsive and continuous noise

Hearing group	Impulsive			Continuous		
	PTS onset thresholds: SEL_{24h} (dB re 1 µPa².s)	**TTS onset thresholds: SEL_{24h} (dB re 1 µPa².s)**	**Behavioural response (dB re 1 µPa)**	**PTS onset thresholds: SEL_{24h} (dB re 1 µPa².s)**	**TTS onset thresholds: SEL_{24h} (dB re 1 µPa².s)**	**Behavioural response (dB re 1 µPa)**
Marine turtles	204	189	166* 175⁺	220	200	(N) High (I) Moderate (F) Low

*Source: PTS and TTS thresholds (Finneran et al., 2017), * behavioural response threshold (NSF 2011), ⁺ behavioural disturbance threshold (McCauley et al. 200).*

Note: The sound units provided in the table above for continuous noise include: relative risk (high, medium and low) is given for marine turtles at three distances from the source defined in relative terms as near (N – tens of metres), intermediate (I – hundreds of metres) and far (F – thousands of metres) (after Popper et al. 2014).

Impact Assessment

The Recovery Plan for Marine Turtles (Commonwealth of Australia, 2017a) 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). However, given the thresholds outlined in **Table 6-13**, it is reasonable to expect that marine turtles may demonstrate avoidance or attraction behaviour to the noise generated by the Petroleum Activities Program.

Increased numbers of marine turtles may be present, albeit still in low numbers within the Operational Area, during internesting periods, and may be exposed to acoustic emissions from vessels during the trenching and material disposal and offshore borrow ground dredging and backfill. However, works of this nature closer or within sensitive turtle area (BIAs and Habitat Critical to the survival) will be limited to a period of months (**Section 4.6.2**) reducing the potential for impact at the individual and population level.

The islands of Dampier Archipelago provide nesting beaches for flatback, green, hawksbill and loggerhead turtles, with Rosemary Island being a major rookery for hawksbill turtles in WA. A study of internesting movements of individuals nesting on the Dampier Archipelago has not been conducted, however, tracking studies at other islands (Barrow and Thevenard) suggest internesting flatback turtles remain in shallow water, close (< 3 km) to nesting beaches (Whittock et al., 2014). The Operational Area overlaps internesting Habitat Critical to the survival of flatback turtles, which is also designated a BIA. However, it is noted that the defined BIA and Habitat Critical are considered very conservative as they are based on the maximum range of internesting females and many marine turtles are more likely to remain near their nesting beaches. There is no evidence to date to indicate flatback turtles swim out into deep offshore waters during the internesting period.

As described above, acoustic modelling was conducted by JASCO (Connell et al., 2021). Based on the application of the multiple SEL_{24h} thresholds (Finneran et al., 2017), PTS was not predicted to occur within the modelling resolution (20 m), and turtles could potentially experience TTS within 150 m (**Table 6-14**). However, marine turtles within the Operational Area are expected to be transient, and unlikely to remain with 150 m of the vessels for 24-hours, and therefore PTS and TTS thresholds are not expected to be reached. Behavioural impacts to marine turtles from continuous noise sources generated by the Petroleum Activities Program are expected to be short-term and localised.

Table 6-14: Maximum predicted horizontal distances (R_{max}) to PTS and TTS thresholds in marine turtles

Hearing group	Sound exposure threshold	R_{max} distance (km)*
Marine turtles	**PTS**	
	220 dB re 1 µPa².s (SEL_{24h})	-
	TTS	
	200 dB re 1 µPa².s (SEL_{24h})	0.15

N.B. A dash indicates the threshold was not reached within the limits of the modelling resolution (20 m).

During geophysical survey activities, the vessel will be continually moving; therefore, any behavioural responses would be temporary and are unlikely to negatively affect individual fitness or breeding success. Additionally, the duration of the activity is limited to days and will not be continuous within the Trunkline Project Area closer to islands/shore, where internesting BIAs are located.

Helicopter noise when on the sea surface may impact turtles (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 to be remote. In the event of a behavioural response to the presence of a helicopter, turtles are expected to exhibit diving behaviour, which is of no lasting effect.

Potential impacts from routine acoustic emissions on marine turtles are expected to be limited to behavioural impacts within a localised area around the project vessels, with no lasting effect.

Fish, Sharks and Rays

A number of demersal and pelagic fish species will be present within the Operational Area. However, given species richness has been shown to correlate with habitat complexity (Gratwicke and Speight, 2005), it is unlikely that the sand/silt sediments that comprise the largest proportion of the Operational Area will support a wide diversity of species. Migratory species such as whale sharks may be present, particularly given a BIA for foraging overlaps of the Trunkline Project Area (KP 50).

Species Sensitivity and Thresholds

The majority of fish species detect sounds from <50 Hz up to 500-1500 Hz (Popper and Hawkins, 2019). A smaller number of species can detect sounds over 3 kHz, while very few species can detect ultrasound over 100 kHz (Ladich and Fay, 2013). The critical issue for understanding whether an anthropogenic sound will affect the hearing of a fish is whether it is within the hearing frequency range of the fish and loud enough to be detectable above background ambient noise.

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 (sharks and rays) 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.

Popper et al. (2014) developed sound exposure guidelines for fish, considering differences in fish physiology (**Table 6-15**).

Table 6-15: Thresholds for PTS, TTS and behavioural response onset in fish, sharks and rays for impulsive and continuous noise

Hearing group	Impulsive			Continuous		
	PTS onset thresholds: SEL_{24h} (dB re 1 μPa².s)	TTS onset thresholds: SEL_{24h} (dB re 1 μPa².s)	Behavioural response (dB re 1 μPa)	PTS onset thresholds: SEL_{24h} (dB re 1 μPa².s)	TTS onset thresholds: SEL_{24h} (dB re 1 μPa².s)	Behavioural response (dB re 1 μPa)
Fish: no swim bladder	216	186	(N) High (I) Moderate (F) Low	(N) Low (I) Low (F) Low	(N) Moderate (I) Low (F) Low	(N) Moderate (I) Moderate (F) Low
Fish: swim bladder not involved in hearing	203	186	(N) High (I) Moderate (F) Low	(N) Low (I) Low (F) Low	(N) Moderate (I) Low (F) Low	(N) Moderate (I) Moderate (F) Low
Fish: swim bladder involving hearing	203	186	(N) High (I) High (F) Moderate	170 dB rms SPL for 48-hours	158 dB rms SPL for 12-hours	(N) High (I) Moderate (F) Low

Impulsive noise:

- *All criteria are presented as sound pressure, even for fish without swim bladders, since no data for particle motion exist.*

Continuous noise:

- *rms SPL: root mean square of time-series pressure level, useful for quantifying continuous noise sources.*

Relative risk (high, moderate, or low) is given for animals at three distances from the source defined in relative terms as near (N), intermediate (I), and far (F).

Source: Popper et al. (2014)

Impact Assessment

Sound produced by the vessels on DP could cause recoverable injury to some fish species with a swim bladder involved in hearing, but only if the fishes are in very close proximity to the sound source, within 280 m, for 12-hours. Similarly, TTS effects could occur within 300 m of the vessels if the fish remained within this distance for 48-hours.

It is expected that potential impact to demersal and pelagic fish and whale sharks is expected to be limited to a behavioural response. Behavioural responses are expected to be short-lived, with duration of effect less than or equal to the duration of exposure. While fish may initially be startled and move away from the sound source, once the source moves on fish would be expected to move back into the area. Further, any fish impacted are unlikely to represent a significant proportion of the population with the Operational Area and the NWS region overall.

Potential impacts from acoustic emissions are likely to be restricted to temporary avoidance behaviour of individuals transiting through the Operational Area, and are therefore considered localised with no lasting effect.

AMPs

For activities occurring within the Montebello Marine Park, and adjacent to the Dampier Marine Park, the short-term and transient nature of activities associated with acoustic emissions will not be inconsistent with the objective of the Multiple Use Zone (VI) to provide for ecologically sustainable use and the conservation of ecosystems, habitats and native species, or for the Habitat Protection Zone (IV) to provide for the conservation of ecosystems, habitats and native species in as natural a state as possible, while allowing activities that do not harm or cause destruction to seafloor habitats. The values identified for both these Marine Parks including BIAs for marine turtles will not be impacted given the significant distance from sensitive locations.

Cumulative Impacts

At the most western extent of the Trunkline Project Area (PLET location) the trunkline route passes within ~2.5 km of the nearest Scarborough development well (Well 5). There is the potential for concurrent activities to occur, with the pipelay vessels (PV, B-Type and OSV) passing within 2.5 km of a MODU on DP engaged in drilling operations at the Well 5 location. The other Scarborough development wells are located >7.5 km from the trunkline route, and therefore noise from the MODU and support vessels is unlikely to result in any significant cumulative impacts.

If this scenario eventuates, there is the potential for cumulative impacts from underwater noise emissions. The combined sound fields are likely to result in a marginal increase the maximum range to the behavioural response threshold for LF cetaceans (i.e. >15 km). However, the Well 5 and PLET location are at least 50 km from the western boundary of the PBW migration BIA, and therefore the likelihood of encountering either migrating or foraging PBW is low. The Scarborough D&C operations will be implementing adaptive management measures for PBW, and in the event that Well 5 is being drilled when there are pipelay operations at the western end of the Trunkline Project Area (i.e. within WA-61-L permit), the control measures for minimising behavioural disturbance to PBW within the migration BIA during migration periods will also be applied.

Therefore, the potential for significant cumulative impacts to PBW from underwater noise emissions to occur from concurrent pipelay and drilling operations is minimal.

Summary of Assessment Outcomes

Receptor	Impact	Receptor Sensitivity Level	Magnitude	Impact Significance Level
Ambient Noise	Change in ambient noise	Low value (open water)	No lasting effect	Negligible (F)
Marine mammals	Change in fauna behaviour Injury/mortality to fauna	High value species	No lasting effect	Slight (E)
Marine reptiles	Change in fauna behaviour Injury/mortality to fauna	High value species	No lasting effect	Slight (E)
Fish, sharks and rays	Change in fauna behaviour Injury/mortality to fauna	High value species	No lasting effect	Slight (E)

Overall Impact Significance Level: The overall impact significance level for routine acoustic emissions is E based on no lasting effect to the high value receptors (marine mammals, marine reptiles, fish, sharks and rays). The impact significance levels for individual receptors are consistent with the levels rated in the Scarborough OPP.

Demonstration of ALARP

Control Considered	***Control Feasibility (F) and Cost/Sacrifice (CS)***	***Benefit in Impact/Risk Reduction***	***Proportionality***	***Control Adopted***
Legislation Codes and Standards				
EPBC Regulations 2000 – Part 8 Division 8.1	F: Yes.	Implementation of controls for reduced	Controls based on legislative	Yes **C 6.1**

Demonstration of ALARP				
Control Considered	***Control Feasibility (F) and Cost/Sacrifice (CS)***	***Benefit in Impact/Risk Reduction***	***Proportionality***	***Control Adopted***
Interacting with cetaceans, including the following measures[1]: • Project vessels will not travel greater than 6 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 6 knots. • Vessels will not travel greater than 8 knots within 250 m of a whale shark and not allow the vessel to approach closer than 30 m of a whale shark.	CS: Minimal cost. Standard practice.	vessel speed around cetaceans can potentially reduce the underwater noise footprint of a vessel and lower the likelihood of interaction above significant thresholds	requirements – must be adopted.	
Good Practice				
The use of trained vessel crew as Marine Fauna Observers (MFOs) on B-Type vessels while the PV is operating in the PBW migration BIA during migration period (Apr-Jul & Oct-Jan), to watch for PBW and notify PV of cetacean presence / activity.	F: Yes. Vessel bridge crews already maintain a constant watch during operations so can be trained in, and carry out, cetacean observations. CS: Additional cost of training	Trained MFO's on vessel bridge can increase understanding of PBW presence in the area of the PV, with information assisting in decision making relating to cumulative noise reduction measures.	Benefits outweigh cost/sacrifice.	Yes **C 6.2**
The use of trained vessel crew as MFOs on the PV while operating in the PBW migration BIA during migration period (Apr-Jul & Oct-Jan), to watch for PBW and record cetacean presence / activity.	F: Yes. Vessel bridge crews already maintain a constant watch during operations so can be trained in, and carry out, cetacean observations. CS: Additional cost of training	Trained MFO's on vessel bridge can increase understanding of PBW presence in the area of the PV, with information assisting in decision making relating to cumulative noise reduction measures.	Benefits outweigh cost/sacrifice.	Yes **C 6.3**

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

Demonstration of ALARP				
Control Considered	***Control Feasibility (F) and Cost/Sacrifice (CS)***	***Benefit in Impact/Risk Reduction***	***Proportionality***	***Control Adopted***
The use of trained vessel crew as MFOs on the OCV while operating in the PBW migration BIA during migration period (Apr-Jul & Oct-Jan), to watch for PBW and record cetacean presence / activity.	F: Yes. Vessel bridge crews already maintain a constant watch during operations so can be trained in, and carry out, cetacean observations. CS: Additional cost of training	Trained MFO's on vessel bridge can increase understanding of PBW presence in the vicinity of the continental slope	Benefits outweigh cost/sacrifice.	Yes **C 6.4**
Implement adaptive management procedures when operating in the PBW migration BIA during migration periods (Apr-Jul & Oct-Jan).	F: Yes. B-type, support, refuelling and other vessels accessing the PV may have the ability to adopt adaptive management procedures CS: Time and monetary cost of delay in vessel activities i.e., pipe unloading or refuelling / supply unloading. Flow on impact to Trunkline installation.	Requiring adaptive management procedures when PBW are present can reduce the likelihood that the whales encounter cumulative underwater noise that is above impact thresholds.	Benefits outweigh cost/sacrifice.	Yes **C 6.5**
When the PV is operating in the PBW migration BIA during migration period (Apr-Jul & Oct-Jan) helicopter pilot(s) to notify PV of cetacean activity on transit out to PV, particularly in proximity to the PV	F: Yes. Helicopter pilots keeping lookout over flight path during transit and have good height/visibility in fair weather conditions. CS: Minimal.	Reporting observations made during transit to the PV can increase understanding of PBW presence in the area of the PV, with information assisting in decision making relating to cumulative noise reduction measures.	Benefits outweigh cost/sacrifice	Yes **C 6.6**
Critical equipment onboard OCV, RIV and TSHD subject to periodic maintenance to ensure optimal performance	F: Yes. Preventative maintenance is a usual activity carried out to maintain vessel systems and equipment. CS: Time and financial cost of maintenance	Ensuring appropriate on-board maintenance occurs for critical equipment (i.e., thrusters) can reduce vibration and in water noise profile of a vessel	Benefits outweigh cost/sacrifice	Yes **C 6.7**
Carry out surveys (aerial / vessel based) around PV to confirm distribution and abundance of PBW, while the PV is operating in the PBW migration BIA during migration period (Apr-Jul & Oct-Jan)	F: Yes. It is possible to carry out aerial/vessel surveys around the PV CS: Financial costs associated with plane/pilot and vessels MFO hire as well as logistics of flight planning. Distance off shore would restrict duration / efficacy of such surveys.	Surveys may increase understanding of PBW activity around the PV but no reduction in likelihood of PBW contact with underwater noise above impact levels that cannot already be achieved by other observation methods.	Cost/sacrifice outweighs benefit	No
If concurrent activities are undertaken by the	F: Yes. B-type, support, refuelling and other	Requiring other vessels on DP to	Benefits outweigh cost/sacrifice.	Yes

Demonstration of ALARP				
Control Considered	***Control Feasibility (F) and Cost/Sacrifice (CS)***	***Benefit in Impact/Risk Reduction***	***Proportionality***	***Control Adopted***
Scarborough D&C operations on Well 5, while the pipelay operations occur within WA-61-L adaptive management measures will be implemented (**C6.5** and **C6.9**)	vessels accessing the PV have the ability to maintain distance from PBW and stand-off from the PV at a safe distance CS: Time and monetary cost of delay in vessel activities i.e., pipe unloading or refuelling / supply unloading. Flow on impact to Trunkline installation.	maintain a distance of 15 km and / or 25 km from the PV while PBW are present can reduce the likelihood that the whales encounter cumulative underwater noise that is above impact thresholds.		**C 6.8**
Professional Judgement – Eliminate				
Eliminate generation of noise from vessels or equipment.	F: No. The generation of noise from these sources cannot be eliminated due to operating requirements. Note that vessels operating on DP may be a safety critical requirement. CS: Inability to conduct the Petroleum Activities Program. Loss of project.	Not considered – control not feasible.	Not considered – control not feasible.	No
Carry out B-type vessel refuelling activities more than 25 km away from the PV if: • PV is operating in the PBW migration BIA during migration period (Apr-Jul & Oct-Jan), and • foraging PBW have been sighted within the Trunkline Project Area in the 60 min prior to refuelling vessel on location.	F: Yes. B-type vessels and refuelling vessels can carry out refuelling activities in any location with a suitable sea-state. CS: Time and monetary cost of delay in refuelling if only suitable location is in close proximity to the PV	Requiring the refuelling activities to be carried out 25 km from the PV while PBW are present can reduce the likelihood that the whales encounter cumulative underwater noise that is above impact thresholds.	Benefits outweigh cost/sacrifice.	Yes **C 6.9**
Professional Judgement – Substitute				
Management of vessel noise by varying the timing of the Petroleum Activities Program to avoid migration periods	F: Yes. It is possible to vary the timing of the Petroleum Activities Program to avoid migration periods, however the risk of potential impacts from routine acoustic emissions is considered to be low, and limited to a behavioural response. CS: Significant cost and schedule impacts due to delays in securing vessels for	Given the potential impacts to migrating fauna during this activity is low, implementation of this control would not result in a reduction in consequence.	Grossly disproportionate. Implementation of the control requires considerable cost minimal environmental benefit. The cost/sacrifice outweigh the benefit gained.	No

Demonstration of ALARP				
Control Considered	***Control Feasibility (F) and Cost/Sacrifice (CS)***	***Benefit in Impact/Risk Reduction***	***Proportionality***	***Control Adopted***
	specific timeframes. The Petroleum Activities Program is due to be undertaken over 12 months with activities completed sequentially; a variation in timing to avoid migration periods would result in significant delays to the project. Ideal (calm) sea states for Trunkline installation occur over the summer months.			
Variation of the timing of the vessel activities to avoid peak turtle internesting periods	F: Yes. It is possible to avoid peak internesting periods, however the risk of potential impacts from acoustic emissions is considered to be low given the location and water depth of the Operational Area. CS: Significant cost and schedule impacts due to delays in securing vessels for specific timeframes. The Petroleum Activities Program is due to be undertaken over 12 months with activities completed sequentially. Ideal (calm) sea states for Trunkline installation occur over the summer months.	Impacts to internesting turtles resulting from acoustic emissions are expected to be low, therefore no reduction in consequence by adopting this control.	Grossly disproportionate. Implementation of the control requires considerable cost sacrifice for minimal environmental benefit. The cost/sacrifice outweigh the benefit gained.	No
Professional Judgement – Engineered Solution				
Carryout maintenance and inspection regime on the PV thrusters prior to mobilisation to Operational Area, to ensure optimal performance	F: Yes. Ability to inspect and maintain thrusters and DP operating systems for PV. CS: Time and monetary cost of inspections and repair activity if required	Ensuring thrusters and DP operating systems are maintained and running at optimal levels reduces vibration and other superfluous noise sources.	Benefits outweigh cost/sacrifice.	Yes **C 6.10**
Use night-time thermal imagery or vessel system prior to vessel transfers at night, to monitor for cetacean activity while the PV is operating in the PBW migration BIA during migration period (Apr-Jul & Oct-Jan).	F: Not Feasible. CS: Cost of technology	Being able to identify cetacean presence at night (whilst not species specific) can reduce the likelihood that the whales encounter cumulative underwater noise that	Not Feasible.	No.

Demonstration of ALARP				
Control Considered	***Control Feasibility (F) and Cost/Sacrifice (CS)***	***Benefit in Impact/Risk Reduction***	***Proportionality***	***Control Adopted***
		is above impact thresholds.		
Use of Autonomous Underwater Vehicle (AUV) to monitor for presence of pygmy blue whales using detection of their vocalisations.	F: Yes. Could be deployed from support vessel CS: Costs associated with obtaining and operating the technology. Schedule delays while data is collected and interpreted (not real time monitoring)	Limited benefit as the technology relies on Pygmy Blue Whale vocalisation, which is currently not well understood, particularly during foraging activities. Technology and applications still under development and not widely tested in field. Application limited due to lack of real time capability.	Cost/sacrifice outweighs benefit.	No

ALARP Statement:

As identified in the DAWE and NOPSEMA guidance on key terms within the CMP, where it can be reasonably predicted that blue whale foraging is probable, known or whale presence is detected, adaptive management (C6.5, C6.8 and C6.9) should be used during industry activities to prevent unacceptable impacts (i.e., no injury or biologically significant behavioural disturbance) to blue whales from underwater anthropogenic noise.

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 2.3.3**), Woodside considers the potential impacts from noise emissions 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 Criteria and Assessment

The Petroleum Activities Program meets the acceptability criteria (**Section 2.3.5**):

- Overall impact significance levels for individual receptors are consistent with the levels rated in the Scarborough OPP.
- EPOs and controls in the Scarborough OPP that are relevant to routine acoustic emissions have been adopted.
- Additional guidance on key terms within the Conservation Management Plan for the Blue Whale (the CMP) was issued in September 2021 and these were considered in the risk assessment and assessment against relevant actions in the CMP. The Petroleum Activities Program is not considered to be inconsistent with the relevant actions of this plan.
- There are no changes to internal/external context specific to this risk from the Scarborough OPP, including issues raised during stakeholder consultation.

Acceptability Statement:

The impact assessment has determined that, given the adopted controls, the Petroleum Activities Program is unlikely to result in an impact significance level greater than Slight. 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.

The potential impacts are considered broadly acceptable if the adopted controls are implemented. Therefore, Woodside considers the adopted controls appropriate to manage the impacts of acoustic emissions to a level that is broadly acceptable.

Environmental Performance Outcomes, Standards and Measurement Criteria			
EPO	**Adopted Control(s)**	**EPS**	**MC**
EPO 6 Undertake the Petroleum Activities Program in a manner that will not modify, destroy, fragment, isolate or disturb an important or substantial area of habitat such that an adverse impact on marine ecosystem functioning or integrity results. **EPO 11** Undertake the Petroleum Activities Program in a manner that will not seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of a migratory species. **EPO 15** Undertake the Petroleum Activities Program in a manner that prevents a substantial adverse effect on a population of fish, marine mammals, marine reptiles, or the spatial distribution of a population.	**C 6.1** EPBC Regulations 2000 – Part 8 Division 8.1 Interacting with cetaceans, including the following measures[2]: • Project vessels will not travel greater than 6 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 6 knots. • Vessel will not travel greater than 8 knots within 250 m of a whale shark and not allow the vessel to approach closer than 30 m of a whale shark.	**PS 6.1** Compliance with EPBC Regulations 2000 – Part 8 Division 8.1 (Regulation 8.05 and 8.06) Interacting with cetaceans to minimise potential for vessel strike.	**MC 6.1.1** Records demonstrate no breaches with EPBC Regulations 2000 – Part 8 Division 8.1 Interacting with cetaceans.
	C 6.2 The use of trained vessel crew as MFOs on B-Type vessels while the PV is operating in the PBW migration BIA during migration period (Apr-Jul & Oct-Jan), to watch for PBW and notify PV of cetacean presence / activity.	**PS 6.2** MFOs onboard B-Type vessels record cetacean presence/activity while operating in the PBW migration BIA during migration period (Apr-Jul & Oct-Jan).	**MC 6.2.1** Records of sighting and locations of marine fauna in the vessels' daily logbook
	C 6.3 The use of trained vessel crew as MFOs on the PV while operating in the PBW migration BIA during migration period (Apr-Jul & Oct-Jan), to watch for PBW and record cetacean presence / activity.	**PS 6.3** MFOs onboard PV record cetacean presence/activity while operating in the PBW migration BIA during migration period (Apr-Jul & Oct-Jan).	

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

Environmental Performance Outcomes, Standards and Measurement Criteria			
EPO	**Adopted Control(s)**	**EPS**	**MC**
	C 6.4 The use of trained vessel crew as MFOs on the OCV while operating in the PBW migration BIA during migration period (Apr-Jul & Oct-Jan), to watch for PBW and record cetacean presence / activity.	**PS 6.4** MFOs onboard OCV record cetacean presence/activity while operating in the PBW migration BIA during migration period (Apr-Jul & Oct-Jan).	
	C 6.5 Implement adaptive management procedures when operating in the PBW migration BIA during migration periods (Apr-Jul & Oct-Jan).	**PS 6.5** While operating in the PBW migration BIA during migration period (Apr-Jul & Oct-Jan), adaptive management procedures implemented.	**MC 6.5.1** Records demonstrate relevant adaptive management procedures implemented.
	C 6.6 When the PV is operating in the PBW migration BIA during migration period (Apr-Jul & Oct-Jan) helicopter pilot(s) to notify PV of cetacean activity on transit out to PV, particularly in proximity to the PV	**PS 6.6** When the PV is operating in the PBW migration BIA during migration period (Apr-Jul & Oct-Jan) helicopter pilots notified PV of identified cetacean activity.	**MC 6.6.1** Records demonstrate helicopter pilot notified PV of identified cetacean activity.
	C 6.7 Critical equipment onboard OCV, RIV and TSHD subject to periodic maintenance to ensure optimal performance	**PS 6.7** Critical equipment maintained as per maintenance systems requirements	**MC 6.7.1** Maintenance systems records of critical equipment
	C 6.8 If concurrent activities are undertaken by the Scarborough D&C operations on Well 5, while the pipelay operations occur within WA-61-L adaptive management measures will be implemented (**C6.5** and **C6.9**)	**PS 6.8** If concurrent activities are undertaken by the Scarborough D&C operations on Well 5, while the pipelay operations occur within WA-61-L **C6.5** and **C6.9** will be implemented.	**MC 6.8.1** Records demonstrate **C6.5** and **C.6.9** implemented if concurrent activities occur during Scarborough D&C operations on Well 5.
	C 6.9 Carry out B-type vessel refuelling activities more than 25 km away from the PV if: • PV is operating in the PBW migration BIA during migration period (Apr-Jul & Oct-Jan), and • foraging PBW have been sighted within	**PS 6.9** No B-type refuelling within 25 km of the PV when: • PV is operating in the PBW migration BIA during migration period (Apr-Jul & Oct-Jan), and • foraging PBW have been sighted within the Trunkline Project Area in the 60 min	**MC 6.9.1** Vessel logs demonstrate B-type vessel refuelling location following sighting of foraging PBW, when PV is operating in the Trunkline Project Area and the PBW migration BIA during migration period (Apr-Jul & Oct-Jan)

Environmental Performance Outcomes, Standards and Measurement Criteria			
EPO	**Adopted Control(s)**	**EPS**	**MC**
	the Trunkline Project Area in the 60 min prior to refuelling vessel on location.	prior to refuelling vessel on location.	
	C 6.10 Carryout maintenance and inspection regime on PV thrusters prior to mobilisation to Operational Area, to ensure optimal performance	**PS 6.10** Maintenance and inspection of PV thrusters undertaken prior to mobilisation to Operational Area.	**MC 6.10.1** Records demonstrate the PV has a maintenance program in place for the thrusters
			MC 6.10.2 Records demonstrate the PV thrusters were inspected prior to mobilisation to the Operational Area.

6.6.7 Routine and Non-Routine Discharges – Vessels and Seabed Intervention

Scarborough OPP – Relevant Impact Assessment Section		
Section 7.1.7 – 7.1.10 – Routine and Non-Routine Discharges		
Context		
Relevant Activities Vessel Operations – **Section 3.7**	**Existing Environment** Marine Regional Characteristics – **Section 4.2** Habitats and Biological Communities – **Section 4.5**	**Stakeholder consultation** Consultation – **Section 5**

Impact/Risk Evaluation Summary

Source of Impact/Risk	*Environmental Value Potentially Impacted*							*Evaluation*						
	Soil and Groundwater	**Marine Sediment**	**Water Quality**	**Air Quality (inc. odour)**	**Ecosystems / Habitat**	**Species**	**Socio-economic**	**Decision Type**	**Impact/Consequence**	**Likelihood**	**Current Risk Rating**	**ALARP Tools**	**Acceptability**	**Outcome**
Routine discharge of sewage, grey water and putrescible wastes to marine environment			✓			✓	✓	A	E	-	-	LCS PJ	Broadly Acceptable	EPO 3
Routine discharge of food waste to the marine environment			✓					A	F	-	-			
Routine discharge of deck and bilge water to marine environment		✓	✓			✓		A	E	-	-			
Routine discharge of brine or cooling water to the marine environment			✓					A	F	-	-			
Cement / grout from seabed intervention activities		✓	✓			✓		A	E	-	-			

Description of Source of Impact/Risk

Accommodation is provided for up to 702 people maximum (usually 550) onboard the PV (Castorone), approx. 90-200 people onboard construction vessels, approx. 220 (maximum 278) people onboard the SWLB and around 20 people onboard support vessels. Project vessels routinely generate/discharge:

- **Sewage and Greywater:** Small volumes of treated sewage, putrescible wastes and grey water will be routinely generated/discharged to the marine environment (impact assessment based on approximate discharge of 5-15 m^3 per vessel per day). Using a rate of 0.375 m^3/person/day as a guide (NERA, 2017), it is expected that vessel discharges will range from ~ 262 m^3/day from the largest vessel (~700 people onboard) to ~ 9.5 m^3/day from a support vessel.
- **Food waste:** Vessel crew and passengers will generate food waste, estimated to be in the order of 1–2 kg per person per day, which will be discharged to the marine environment under controlled conditions.
- **Deck and Bilge Water:** Routine/periodic discharge of relatively small volumes of bilge water will occur from vessels. Bilge tanks receive fluids from many parts of the vessels. Bilge water can contain water, oil, detergents, solvents, chemicals, particles and other liquids, solids or chemicals. There is also variable water discharge from vessel decks directly overboard or via deck drainage systems. Potential sources include rainfall events and/or deck activities such as cleaning/wash-down of equipment/decks. Lubricants may be used in equipment such as the grab dredger and TSHD drag head.

- **Brine and Cooling Water:** Cooling water from machinery engines and brine water produced during the desalination process of reverse osmosis to produce potable water on board the vessels will be routinely discharged. Depending on vessel, seawater used for cooling purposes will be routinely discharged at a temperature expected to be less than 70°C and rates of approximately 50 m³/d.
- **Cement and Grout:** During span rectification works, cement discharges may occur from overflow while filling/filtering of cement through cement bags for span rectification; line washout (down line cleaning); or cement unit washout from onboard the vessel.

Project vessels are predominantly transient through the Operational Area whilst discharging, with the greatest risk associated with the PV given the low transit speed during activities. The Petroleum Activities Program may not be executed as a single campaign or in a consecutive sequence, therefore the routine and non-routine vessel discharges may occur at any time during the approval period of the EP.

Detailed Impact Assessment

Assessment of Potential Impacts

Water Quality

Monitoring of vessel sewage discharges has demonstrated that a 10 m³ sewage discharge over 24 hours from a stationary source in shallow water, reduced to about 1% of its original concentration within 50 m of the discharge location (Woodside, 2008). Monitoring stations confirmed that discharges were rapidly diluted or nutrients rapidly metabolised and no elevations in water quality parameters (e.g. total nitrogen, total phosphorous and selected metals) were recorded above background levels at any station.

Discharge of food waste has the potential to change the local water quality for a short period through the addition of a temporary nutrient source, however this nutrient loading would rapidly return to background conditions following dispersion in the water.

Deck drainage and treated bilge water may contain a range of chemicals, oil, grease and solid material; however these discharges are expected to rapidly dilute in the water column (Shell, 2010). In addition, vessels are typically moving during discharges of treated bilge water, which promotes mixing and dilution.

The key physicochemical stressors that are associated with reject brine and cooling water discharge include salinity, pH, temperature and chemical toxicity. Water quality of the surrounding environment may be altered through the addition of chemicals and an increase in salinity. Scale inhibitors and biocides are commonly used within the systems described above to prevent fouling. Scale inhibitors are typically low molecular weight phosphorous compounds that are water-soluble, and only have acute toxicity to marine organisms about two orders of magnitude higher than typically used in the water phase (Black et al., 1994). The biocides typically used in the industry are highly reactive and degrade rapidly (Black et al., 1994).

The potential impacts on water quality due to cooling water discharge include chlorine toxicity and increased water temperatures. Discharges will disperse and dilute rapidly, with impacts to water quality localised to the discharge point.

Reject brine water is typically 20–50% higher in salinity to the surrounding water and based on models developed by the US EPA (Frick et al., 2001), discharges of brine water will sink through the water column where it will be rapidly mixed with receiving waters and dispersed by ocean currents, decreasing in salinity rapidly as distance from source increases.

Generally, reject brine and cooling water containing chemical additives are inherently safe at the low dosages used. They are usually consumed in the inhibition process, so there is little or no residual chemical concentration remaining upon discharge.

Cement discharges may occur, from overflow, and can result in turbidity in the water column. Reduction in water quality will be temporary (limited to the cement operational discharges) and due to small volumes are likely to be subject to rapid dispersion and dilution by prevailing currents.

Impacts from routine and non-routine discharges from vessels on water quality will have no lasting effect due to the transient nature of vessels, with little continuous discharge in a stationary location. Project vessels with the greatest volumes of discharge and slow transit speed are expected to be operational for a short duration (<6 months), Furthermore, routine and non-routine vessel discharges occur in a localised mixing zone, with a high level of dilution into the open water marine environment of the Operational Area.

Sediment Quality

Impacts associated with routine and non-routine deck and bilge water discharges will be limited to the area surrounding the discharge source of the vessel. Due to the dispersive nature of the discharges within the highly mixed offshore marine environment, any toxins associated with transient surface discharges are not expected to reach marine sediments at concentrations that will result in notable changes to sediment quality.

Increased salinity and other toxins from chemical additives in brine and cooling water discharges could potentially accumulate in benthic sediments, causing changes to sediment quality. However, the transient nature of project vessels and the water depth of the Operational Area (approximately 31 m at the State waters boundary to 1400 m near the

FPU), indicate discharges of cooling water and brine are expected to disperse before reaching the seabed and no change in sediment is expected.

Cement discharges at the seabed are expected to be minimal and once the cement has hardened, chemical additives are locked into the cement (Terrens et al., 1998) and not expected to pose any toxicological risk to benthic biota from leaching or direct contact. The physical sediment properties of the area directly adjacent to the discharge location will be permanently altered however it will be a highly localised physical footprint and is not expected to affect the overall diversity or ecosystem function of the benthic communities of the area.

The potential impacts to benthic communities caused by smothering from a surface release of cement are expected to be minimal due to small volumes, intermittent nature of these discharges, and high potential for dispersal by ocean currents. This impact on soft sediment communities is not expected to affect the diversity or ecosystem function in this area and is only considered a localised impact.

Marine Fauna

A change in water quality from the discharge of sewage and greywater could result in injury or mortality to marine fauna. This could be the result of oxygen depletion in the waters due to nutrient enrichment, or due to toxins and chemicals present in the discharged wastes. Open marine waters are typically influenced by regional wind and large-scale current patterns resulting in the rapid mixing of surface and near surface waters where sewage discharges may occur. This means nutrients from the discharge of sewage will not accumulate or lead to eutrophication due to the highly dispersive environment. Therefore, the receptors with the greatest potential to be impacted are those in the immediate vicinity of the discharge (NERA, 2017). Given that sewage discharges from vessels are at or near the surface, and remain buoyant, the receptors with the potential to be impacted are also those within or on surface waters; i.e. plankton, fish and other marine fauna.

Discharge of food waste into the marine environment has the potential to attract some opportunistic marine fauna including fish and seabirds to the area in response to the increased food availability or, indirectly because of attraction of prey species. However, given the small quantities of food waste to be disposed, any attraction is likely to be minor, temporary and localised.

As a result of a change in water quality, further impacts to receptors may occur, which include injury or mortality to marine fauna resulting from exposure to toxins in the deck drainage and treated bilge water discharge. The discharges, which may include non-organic contaminants, will rapidly dilute. Such discharges are expected to be intermittent and in very small quantities and concentrations as to not pose any significant risk to any relevant receptors.

As discharges will be sporadic (i.e. no continuous flow), there is no potential for fluids to accumulate in the water column.

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 4.5.1**). Increased salinity and other toxins from chemical additives in brine and cooling water discharges could potentially harm marine fauna. Due to the relatively inert properties and low concentrations of scale inhibitors and biocides within the brine and cooling water discharge, the high level of dilution and mixing within the receiving offshore environment and the limited area of impact, impacts (if any) to pelagic species are expected to be highly localised.

Plankton

Routine and non-routine discharges may affect the ecophysiology of marine organisms as a result in changes of salinity. Studies indicate that effects from increased salinity on planktonic communities in areas of high mixing and dispersion are generally limited to the point of discharge only (Azis et al., 2003). Research has demonstrated that zooplankton are not affected in areas of sewerage or greywater discharge for transient vessels (Mearns et al., 2003; Ytreberg et al., 2020). Plankton communities are expected to rapidly recover from short term, localised impacts due to their naturally high mortality, and rapid replacement rates (UNEP, 1985).

Planktonic productivity in the NWMR is low. No significant impacts from the planned routine discharges are expected, 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. Impacts to plankton from grey water, sewerage or brine and cooling water discharges is not expected.

Aesthetic Values

The composition of sewage and greywater may include physical particulate matter such as solids composed of floating, settle able, colloidal and dissolved matter. These substances can affect aspects of aesthetics such as ambient water colour, the presence of surface slicks/sheens and odour. However, as vessels will be moving during the discharge of sewage and greywater, this will promote mixing and dilution of the waste.

Given the distance of the project offshore, the proximity of water quality changes to the discharge source, the rapid consumption of matter by planktonic species and bacteria, and the spatial nature of tourism and recreation activities and coastal settlements (i.e. on or near the shoreline); impacts to receptors associated with changes in aesthetic values are not expected to occur.

Summary of Assessment Outcomes				
Receptor	**Impact**	**Receptor Sensitivity Level**	**Magnitude**	**Impact Significance Level / Risk Consequence**
Water quality	Change in water quality	Low value (open water)	No Lasting Effect	Negligible (F)
Sediment quality	Change in sediment quality	Low value	No Lasting Effect	Negligible (F)
Migratory Shorebirds and Seabirds	Injury/mortality or behavioural changes to marine fauna	High value species	No lasting effect	Slight (E)
Fish		High value species	No lasting effect	Slight (E)
Marine Mammals		High value species	No lasting effect	Slight (E)
Marine Reptiles		High value species	No lasting effect	Slight (E)
Plankton		Low value (open water)	Negligible (F)	Highly Unlikely
Overall Impact Significance Level/ Risk Consequence: The overall impact significance level for routine and non-routine discharges from vessels is E based on no lasting effect to marine fauna. The impact significance level for water quality is consistent with the level rated in the Scarborough OPP. Potential impacts to marine fauna have been additionally assessed in this EP. There is no change in magnitude of impact (no lasting effect); however, the impact significance level is slightly higher due to the higher receptor sensitivity level.				

Demonstration of ALARP				
Control Considered	***Control Feasibility (F) and Cost/Sacrifice (CS)***	***Benefit in Impact/Risk Reduction***	***Proportionality***	***Control Adopted***
Legislation, Codes and Standards				
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.	No reduction in likelihood or consequence would result.	Controls based on legislative requirements – must be adopted.	Yes **C 7.1**
Marine Order 96 – Pollution prevention – Sewage (as appropriate to vessel class) which include the following requirements: • a valid International Sewage Pollution Prevention (ISPP) Certificate, as required by vessel class • an AMSA-approved sewage treatment plant • a sewage comminuting and disinfecting system	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 7.2**

Demonstration of ALARP				
Control Considered	***Control Feasibility (F) and Cost/Sacrifice (CS)***	***Benefit in Impact/Risk Reduction***	***Proportionality***	***Control Adopted***
• 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 4 knots), to avoid discharges in environmentally sensitive areas.				
Marine Order 91 – Oil (as relevant to vessel class) requirements, which include mandatory measures for the processing of oily water prior to discharge: • Machinery space bilge/oily water shall have International Maritime Organisation (IMO) approved oil filtering equipment (oil/water separator) with an on-line monitoring device to measure Oil in Water (OIW) content to be less than 15 ppm prior to discharge. • IMO approved oil filtering equipment shall also have an alarm and an automatic stopping device or be capably of recirculating in the event that OIW concentration exceeds 15 ppm. • A deck drainage system shall be capable of controlling the content of discharges for areas of	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 7.3**

Demonstration of ALARP				
Control Considered	***Control Feasibility (F) and Cost/Sacrifice (CS)***	***Benefit in Impact/Risk Reduction***	***Proportionality***	***Control Adopted***
high risk of fuel/oil/grease or hazardous chemical contamination. • There shall be a waste oil storage tank available, to restrict oil discharges. • In the event that machinery space bilge discharges cannot meet the oil content standard of <15 ppm without dilution or be treated by an IMO approved oil/water separator, they will be contained on-board and disposed of onshore. Valid International Oil Pollution Prevention Certificate.				
Good Practice				
Chemicals will be selected with the lowest practicable environmental impacts and risks subject to technical constraints.	F: Yes. CS: Minimal cost. Standard practice.	Environmental assessment of chemicals in discharges 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 7.4**
Professional Judgement - Eliminate				
No additional controls identified.				
Professional Judgement – Substitute				
Storage, transport and treatment/disposal onshore of routine discharges.	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	Not considered – control not feasible.	Not considered – control not feasible.	No

Demonstration of ALARP				
Control Considered	***Control Feasibility (F) and Cost/Sacrifice (CS)***	***Benefit in Impact/Risk Reduction***	***Proportionality***	***Control Adopted***
	the implementation of this control not feasible. CS: Not considered – control not feasible.			
Professional Judgement – Engineered Solutions				
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 2.3.3**), Woodside considers the adopted controls appropriate to manage the impacts of planned routine and non-routine discharges from 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 Criteria and Assessment
The Petroleum Activities Program meets the acceptability criteria (**Section 2.3.5**): • Overall impact significance level for water quality is consistent with the level rated in the Scarborough OPP. As discussed above, potential impacts to marine fauna have been additionally assessed in this EP. There is no change in magnitude of impact (no lasting effect); however, the impact significance level is slightly higher due to the higher receptor sensitivity level. This is not considered a significant change to the overall environmental impact and risk assessed in the Scarborough OPP. • EPOs and controls in the Scarborough OPP that are relevant to routine discharges have been adopted. • There are no changes to internal/external context specific to this risk from the Scarborough OPP, including issues raised during stakeholder consultation.
Acceptability Statement: The impact assessment has determined that, given the adopted controls, routine and non-routine discharges vessels are unlikely to result in an impact significance level greater than negligible. A number of BIAs for EPBC Act listed Threatened or Migratory species overlap the Operational Area (refer to **Section 4.6**).The adopted controls are considered consistent with industry legislation, codes and standards, and professional judgement and meet the requirements of Australian Marine Orders. The potential impacts are considered broadly acceptable if the adopted controls are implemented. Therefore, Woodside considers the adopted controls appropriate to manage the impacts of these discharges to a level that is broadly acceptable.

Environmental Performance Outcomes, Standards and Measurement Criteria			
EPO	***Adopted Control(s)***	***EPS***	***MC***
EPO 3 Undertake the Petroleum Activities Program in a manner that does not result in a substantial change in water quality which may adversely impact on biodiversity, ecological integrity, social amenity or human health.	**C 7.1** 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.	**PS 7.1** Vessels compliant with Marine Order 95 – Pollution prevention – garbage.	**MC 7.1.1** Records demonstrate vessels are compliant with Marine Order 95 – Pollution prevention (as appropriate to vessel class).

Environmental Performance Outcomes, Standards and Measurement Criteria			
EPO	***Adopted Control(s)***	***EPS***	***MC***
	C 7.2 Marine Order 96 - pollution prevention – sewage (as appropriate to vessel class) which include the following requirements: • a valid International Sewage Pollution Prevention (ISPP) Certificate, as required by vessel class • an AMSA-approved sewage treatment plant • a sewage comminuting and disinfecting system • a sewage holding tank sized appropriately to contain all generated waste (black and grey water); • discharge of sewage which is not comminuted or disinfected will only occur at a distance of more than 12 nm from the nearest land • discharge of sewage which is comminuted or disinfected using a certified approved sewage treatment plant will only occur at a distance of more than 3 nm from the nearest land • discharge of sewage will occur at a moderate rate while support vessel is proceeding (more than 4 knots), to avoid discharges in environmentally sensitive areas.	**PS 7.2** Vessels compliant with Marine Order 96 – Pollution prevention – Sewage (as appropriate to vessel class).	**MC 7.2.1** Records demonstrate vessels are compliant with Marine Order 96 – Pollution prevention – Sewage (as appropriate to vessel class).
	C 7.3 Marine Order 91 – oil (as relevant to vessel class) requirements, which includes mandatory measures for the processing of oily water prior to discharge: • Machinery space bilge/oily water shall have IMO-approved oil	**PS 7.3** Discharge of machinery space bilge/oily water will meet oil content standard of <15 ppm without dilution.	**MC 7.3.1** Records demonstrate discharge specification met for vessels**.**

Environmental Performance Outcomes, Standards and Measurement Criteria			
EPO	***Adopted Control(s)***	***EPS***	***MC***
	filtering equipment (oil/water separator) with an on-line monitoring device to measure Oil in Water (OIW) content to be less than 15 ppm prior to discharge. • IMO-approved oil filtering equipment shall also have an alarm and an automatic stopping device or be capable of recirculating in the event that 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. • In the event that machinery space bilge discharges cannot meet the oil content standard of <15 ppm without dilution or be treated by an IMO-approved oil/water separator, they will be contained on-board and disposed of onshore. • Valid International Oil Pollution Prevention Certificate		
	C 7.4 Chemicals will be selected with the lowest practicable environmental impacts and risks subject to technical constraints.	**PS 7.4** Reduces to ALARP the impact potential of all chemicals intended or likely to be discharged into the marine environment.	**MC 7.4.1** Records demonstrate chemical selection, assessment and approval process for selected chemicals is followed.

6.6.8 Routine and Non-Routine Discharges – Trunkline Installation and Pre-commissioning

Scarborough OPP – Relevant Impact Assessment Section		
Scarborough OPP Section 7.1.12 - Routine and Non-Routine Discharges: Subsea Installation and Commissioning		
Context		
Relevant Activities Trunkline Pre-commissioning – **Section 3.11.5**	**Existing Environment** Physical Environment – **Section 4.4** Habitats and Biological Communities – **Section 4.5**	**Stakeholder consultation** Consultation – **Section 5**

Impact/Risk Evaluation Summary

Source of Impact/Risk	*Environmental Value Potentially Impacted*							*Evaluation*						
	Soil and Groundwater	**Marine Sediment**	**Water Quality**	**Air Quality (inc. odour)**	**Ecosystems / Habitat**	**Species**	**Socio-economic**	**Decision Type**	**Impact/Consequence**	**Likelihood**	**Current Risk Rating**	**ALARP Tools**	**Acceptability**	**Outcome**
Trunkline Pre-commissioning discharges (FCGT / hydrotest)		✓	✓		✓	✓		A	E	-	-		Broadly Acceptable	EPO 3, 6, 16,17,18
Contingent Trunkline discharges i.e. wet buckle		✓	✓		✓	✓		A	F	-	-			

Description of Source of Impact/Risk

Pre-commissioning

Pre-commissioning testing of the trunkline will be undertaken to test integrity, as outlined in **Section 3.11.5,** with dry pre-commissioning as the preferred option. FCGT or wet pre-commissioning may be carried out as a contingent activity, which will result in a discharge to the marine environment. Discharge options include:

- FCGT of the full trunkline in the unlikely event that installation of the Commonwealth section of the Trunkline compromised integrity, with discharge in Commonwealth waters at the PLET (WA-61-L)
- FCGT of the State waters section of the trunkline (i.e. nearshore component) with discharge in Commonwealth waters near the State waters boundary.

FCGT – full trunkline at PLET

If full FCGT is used, the trunkline will be filled with treated seawater, hydrotested and dewatered, then dried and inerted. The activity would be conducted in two phases, firstly pre-flooding and cleaning with a total discharge of approximately 254,300 m^3 with expected chemical concentration of 350 mg/L and discharged at a rate of ~1000 m^3/hr. This would be followed by a period of time sufficient to ensure concentration of chemicals in the environment is below 99% species protection threshold (determined by modelling), then the hydrotest itself would occur which results in a discharge of approximately 246,000 m^3 with expected chemical concentration of 550 mg/L at various flow rates from 130 m^3/hr to 1500 m^3/hr but on average significantly lower than the pre-flood/cleaning.

FCGT – nearshore component near State waters boundary

This scenario is similar to the FCGT of the full trunkline with smaller volume (as only around 33 km of trunkline will have been laid). Discharge of pre-flooding and cleaning water will be approximately 29,000 m^3 with chemical concentration of 350 mg/L, followed by a period of time to allow concentrations to decrease below 99% species protection threshold, then the hydrotest which will result in a discharge of the same volume with chemical concentration of 550 mg/L. Discharge rate for both pre-flooding/cleaning and hydrotest is 1000 m^3.

Pipelay - Wet Buckle

During trunkline installation, contingency dewatering may be required to remove untreated seawater from the flowline (e.g. a wet buckle event). This would require the trunkline to be dewatered with treated seawater. Seawater will be treated with the same chemicals, in the same concentrations, as for the contingent FCGT process. The Trunkline would be dewatered from shore to offshore. The discharge could occur at any point along the Trunkline, with the location dependent on where the Trunkline was cut to remove the buckled section. Irrespective of where the discharge occurs, the dewatering discharge volume would be a small, fixed volume of approximately 1,200 m^3 and considered to be within the impact considered for the other far larger discharges.

<u>Quantitative Risk Assessment</u>

In order to understand the potential impacts and risks associated with the discharge of hydrotest fluid under the worst case scenarios, Woodside commissioned RPS to model the fate and transport of two representative discharge scenarios, one at the PLET and another in Commonwealth waters near the State waters boundary (RPS, 2021). To determine the fate, transport and dilution of the hydrotest discharge, both near-field and far-field modelling was undertaken as these are used to describe different processes and scales of effect.

A three-dimensional, spatially-varying current data set surrounding the discharge locations for a ten-year (2006-2015) hindcast period were used, with summer, winter and transitional seasons modelled. The data set included the combined influence of drift and tidal currents and was suitably long as to be indicative of interannual variability in ocean currents. The current data set was validated against metocean data collected in the Scarborough Project Area.

Due to the proposed chemical additives with the hydrotest fluid (i.e., biocides, corrosion inhibitors, oxygen scavenger, fluorescent dyes), the discharges have the potential to impact sensitive receptors within the discharge area of influence, primarily through toxicological effects ranging from the inhibition of key biological processes (e.g., reproduction) to mortality. The outputs of the quantitative modelling are used to assess the environmental risk by delineating which areas of the marine environment could be exposed to chemicals exceeding toxicological threshold concentrations, and the expected time taken for concentrations to reduce to below thresholds.

For the purpose of the impact assessment, the hydrotest chemical treatment is assumed to be Hydrosure 0-3670R as a conservative analogue for other chemical treatments. Hydrosure 0-3670R is a proprietary chemical mixture designed for the treatment of water (neutralising bacteria and dissolved oxygen). The chemical contains 10-30% quaternary ammonium chloride as a biocide, along with an oxygen scavenger and corrosion inhibitor.

To identify the potential toxicity of the hydrotest fluids following discharge to the marine environment, Chevron Australia Pty Ltd (2015) conducted whole effluent toxicity (WET) testing on Hydrosure 0-3670R (Champion Chemicals Pty Ltd), diluted in seawater. WET testing was undertaken on five locally relevant species from four different taxonomic groups based on ANZECC & ARMCANZ (2000). Since Hydrosure 0-3670R is a mixture containing both the biocide and oxygen scavenger for chemical treatment, only one assay in each test species was necessary to evaluate the toxicity of the product. The results from this study established a 99% species protection value of 0.06 mg/L, which was applied in the modelling over a 48-hr rolling median (Chevron Australia Pty Ltd, 2015). Based on the expected initial concentration of 350 mg/L for pre-flooding and cleaning water, 5,833 dilutions are required, and initial concentration of 550 mg/L for hydrotesting, 9,167 dilutions are required to meet threshold concentration.

The 99% species protection level concentration is suggested by the Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZG, 2018) for the development of environmental criteria for high conservation ecosystems or chemicals that have a tendency to bioaccumulate. It was assumed that the residual discharge concentration of the chemicals within the fluid is the same as the initial dosing concentration with no degradation or decay during residence within the pipeline. This represents a conservative approach as it likely over represents the residual toxicity of the fluid following discharge.

Pre-Commissioning Discharge

FCGT – full trunkline modelling results

Nearfield modelling results for discharge at the offshore PLET location indicates that a turbulent mixing zone will be created at the seabed, for a horizontal distance of ~90 to 115 m, with a vertical distribution up to 40 m. Outside of this turbulent zone, a positively buoyant plume is expected to rise in the water column, which may reach a horizontal distance of up to ~425 m from the PLET prior to reaching trapping depth.

Farfield modelling for this discharge indicates that dilutions required to reach the threshold concentration (0.06 mg/L) at the 95th percentile (applied as a 48-hour rolling median) for the pre-flooding and cleaning water (additive concentration 350 mg/L) is achieved at a maximum distance of ~6,100 m from the PLET. This covers an area of ~20 km^2. Similarly, the maximum distance to achieve threshold concentration at 95th percentile (applied as a 48 hr rolling median) for the hydrotest discharges (additive concentration 550 mg/L) is ~1,400 m from the PLET. This covers an area of ~2.2 km^2. The significantly greater spatial rate of dilution for hydrotest discharge when compared with pre-flood/cleaning is attributed to the lower rate of discharge.

The maximum time for concentrations to fall below threshold concentration under weak current conditions (resulting in low mixing and low dilution) was 2.77 days. Therefore a minimum time period of 3 days will be applied between pre-flooding/cleaning and hydrotest discharges for the full trunkline FCGT.

FCGT – nearshore component modelling results

Nearfield modelling results for nearshore component discharge adjacent to the State waters boundary indicates that a turbulent mixing zone will be created at the seabed, for a horizontal distance of ~40 m, with vertical distribution around 10 m. Outside of this turbulent zone, a positively buoyant plume is expected to rise in the water column, which may reach a horizontal distance of up to ~60 m from the discharge location prior to reaching trapping depth.

Farfield modelling for this discharge indicates that dilutions required to reach the threshold concentration (0.06 mg/L) at the 95th percentile (applied as a 48-hour rolling median) for the pre-flooding and cleaning water (additive concentration 350 mg/L) is achieved at a maximum distance of ~2100 m from the release location. This covers an area of ~2.1 km^2. Similarly, the maximum distance to achieve threshold concentration at 95th percentile (applied as a 48 hr rolling median) for the hydrotest discharges (additive concentration 550 mg/L) is ~4,100 m from the release location. This covers an area of ~6.4 km^2. In this scenario, given the reduced volume it is the increased chemical concentration in the hydrotest discharge which is driving the larger area of influence.

The maximum time for concentrations to fall below threshold concentration under weak current conditions (resulting in low mixing and low dilution) was 2.93 days. Therefore, a minimum time period of 3 days will also be applied between pre-flooding/cleaning and hydrotest discharges for the nearshore component FCGT.

Dilution contours for this discharge in context of nearby receptors are shown in **Figure 6-5.**

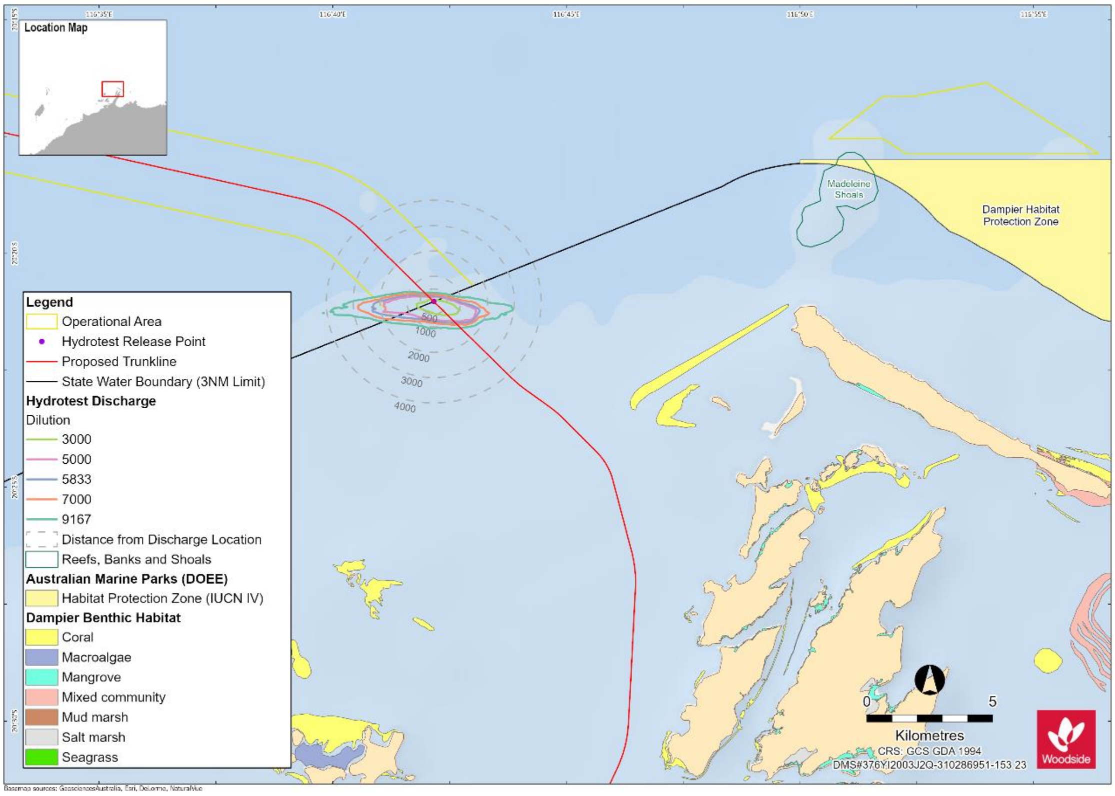


Figure 6-5: Expected dilution contours for a seabed discharge of 29,000 m^3 in Commonwealth waters adjacent to the State waters boundary

Detailed Impact Assessment

Assessment of Potential Impacts

Water and Sediment Quality

Background water quality in the NWMR is influenced by large tidal regimes and strong oceanographic currents. Water quality in Trunkline Project Area is likely to be unpolluted tropical offshore environment, nutrient poor and reflects the offshore oceanic conditions of the wider Western Australian region, with the exception of existing disturbances in ports. Similarly, marine sediments are typical of the continental slope in the Northwest Transition bioregion, consisting of soft sandy clay/silt (**Section 4.4.3**).

Stochastic and deterministic modelling of the FCGT discharge scenarios indicates that chemical concentrations are expected to be below the 99% species protection level within 6,100 m and 4,100 m of the PLET and State waters boundary release locations respectively, with changes in water quality predicted to return below the threshold value within approximately three days of completing the discharges.

The presence of chemical additives in discharged hydrotest fluids are expected degrade, decay, dilute and disperse once released through both dynamic mixing in the nearfield and by prevailing currents in the farfield, due to the open oceanic waters of the Project Area. The discharge is expected to remain close to the seabed which means the temporary change in water quality will be restricted to deep waters at the PLET location and predominantly near seabed at the release location near the State waters boundary. As such, the discharge is expected to result in a temporary decline in water quality around the discharge locations, with no lasting effect on water quality is predicted.

As the discharge plume is expected to remain close to the seabed, a temporary change in sediment quality may occur. However, as demonstrated by the modelling, due to rapid dispersion of the treated seawater, the chemical additives will degrade and dilute rapidly following discharge with no predicted accumulation within seabed sediments and as such no lasting effect on sediment quality is predicted

Impacts from routine and non-routine discharges of pre-commissioning or installation fluids will have a slight effect on water and sediment quality. Receptor sensitivity is low (low value, open water), and therefore Impact Significant Level of routine and contingent discharges of pre-commissioning or installation fluids on water quality and sediment quality is negligible.

Injury/mortality to Marine Fauna

Plankton

A change in water quality has the potential to result in the injury or mortality of planktonic species in the water column due to toxicity. Ichthyoplankton (eggs, larvae) are the most susceptible organisms to chemical exposure, as they have limited mobility and thus likely to be exposed to the plume if present. These organisms however, have a high natural mortality and rapid replacement rate and are therefore likely to recover after activity ceases.

Stochastic and deterministic modelling of the FCGT discharge scenarios indicates that chemical additive concentrations are expected to be below the 99% species protection level within 6,100 m and 4,100 m of the PLET and State waters boundary release locations respectively, with changes in water quality predicted to return below the threshold value within approximately three days of completing the discharges.

Treated seawater discharge in the unlikely event of full Trunkline FCGT will occur close to the seafloor in water depths of about 1400 m at the PLET location. Given phytoplankton and zooplankton are generally limited to near-surface waters (i.e., the photic and meso-photic zones) no lasting effect on plankton is expected.

Plankton populations may be affected by hydrotest discharges for the State waters section of the Trunkline adjacent to the State waters boundary. However, given the expected rapid dispersion and dilution of the plume by prevailing currents and the temporary nature of the discharge, impacts to plankton are likely to only occur in the immediate area of the discharge plume, over a period of days to weeks. Given the fast population turnover of open water plankton populations (ITOPF, 2011), the potential impacts are expected to be localised and temporary.

Discharges during pipelay or pre-commissioning or installation activities will be restricted to a small area around the discharge point and will disperse rapidly in the environment. Impacts from contingent treated seawater discharges will have no lasting effect on plankton.

Epifauna and infauna

As a result of a change in sediment or water quality, impacts to benthic habitat receptors may occur. This may include sub-lethal effects or mortality to benthic epifauna and infauna resulting from the increased (water) or accumulation of (sediment) potential contaminants and toxins. Epifauna and infauna sensitivity to dewatering discharges is expected to be similar to pelagic invertebrate species such as plankton.

Benthic infauna and epifauna communities at the PLET are primarily soft sediment communities featuring burrowing organisms. Sparse ascidians, sponges, and octocorals may be present along the Trunkline route. No primary producer communities (hard corals, seagrass, macroalgae) are expected to occur due to the lack of light. Stochastic and deterministic modelling of the FCGT discharge scenario at the PLET indicates that chemical additive concentrations are expected to be below the 99% species protection threshold within 6.1 km of the discharge location. Discharge concentrations are therefore not expected to extend to any location where sensitive benthic communities may be present.

Stochastic and deterministic modelling of the nearshore component FCGT discharge near the State waters boundary indicates that chemical additive concentrations are expected to be below the 99% species protection threshold within 4.1 km of the discharge location. Therefore, there is potential for a localised area of epifauna to be exposed to lethal and sub-lethal concentrations near the release location. Due to rapid dispersion of the treated seawater, uptake and bioaccumulation of contaminants is not expected to occur in sediments or benthic organisms beyond the point of release.

Discharges during pre-commissioning or pipelay activities will therefore be restricted to a relatively small area around the discharge point and will disperse rapidly in the environment. The extent of seabed exposure at levels where impacts could occur will be small, and potential impacts are expected to be localised, temporary and negligible. Impacts from contingent treated seawater discharges will have no lasting effect on epifauna and infauna.

Marine Fauna

The location of the FCGT discharge at the PLET does not overlap any BIAs for protected marine fauna and given the water depth (about 1400 m) and temporary nature of the discharge, impacts to protected species are not expected. The deep water and predominantly featureless, flat soft sediment seabed at the PLET discharge location is of low complexity and low productivity (see **Section 4.5**) and reduces the species diversity and richness of pelagic and demersal fish assemblages. Although sporadic upwelling events and increased primary productivity along the along the northern and southern boundaries of the Exmouth Plateau KEF may temporarily increase fish diversity, overall, fish fauna is not expected to be abundant at the FCGT discharge location, which is located >50 km from the periphery of the plateau. Continental slope fish communities off the west coast of Australia (including the Exmouth Plateau) have a low overall density, which appears to be linked to the low biological productivity of the overlying waters (Williams et al., 2001). In the event of a wet buckle, discharge volumes of treated seawater will be limited to the length of pipeline requiring dewatering and will similarly result in a temporary reduction in water quality (within metres) with negligible effect to protected fauna.

The FCGT discharge location near the State waters boundary is located in the humpback whale migration BIA, as well as in internesting BIAs and Habitat Critical for a number of marine turtle species. Stochastic and deterministic modelling indicates that potential impacts to protected marine fauna, as well as pelagic or demersal fish species from pre-commissioning discharges or wet buckle contingency discharges, are expected to be confined to the vicinity of discharge point.

Fish are likely to be transient within the receiving environment adjacent to the discharge location, and as such are unlikely to be exposed to sufficient concentrations or durations of the discharge constituents to elicit a response, particularly given the 99% species protection threshold and the subsequent mixing zone have been determined through the application of chronic exposure ecotoxicological tests on sensitive life stage marine fauna. In addition, the predicted toxicity effects on fish within the mixing zone are considered conservative given that the chemical constituents within the pre-commissioning discharge are likely to be subject to natural degradation following discharge. Furthermore, fish and other marine fauna have the capacity to adapt their behaviour in response to changes in environmental conditions and can be expected to move away from the discharge if exposed.

The low likelihood of pelagic species being exposed to the discharge; and the ability of fish to move away from the discharge plume, the potential for toxic impacts to occur from contingent treated seawater discharge are considered to be localised, short-term and no lasting effect at the population or bioregional scale.

KEFs

The FCGT discharge location at the PLET occurs within the Exmouth Plateau KEF. The Exmouth Plateau is defined as a KEF as it is a unique seafloor feature with ecological properties of regional significance, which apply to both the benthic and pelagic habitats within the feature. Therefore, as a result of a change in sediment quality and/or water quality, potential impacts to this KEF may occur. Values of the Exmouth Plateau with the potential to be affected by dewatering is limited to impacts to benthic environments containing low habitat heterogeneity within the plume. There is no solids component in the discharge, and therefore no smothering or alteration of the seabed is expected to occur.

The seafloor composition within the area of the dewatering discharge is expected to primarily be mud and clay material. Survey of the plume area identified the seafloor to contain sparse marine life dominated by motile taxa typical of deep-water soft substrates (ERM, 2013; DEWHA, 2008).

Impacts from contingent discharges of treated seawater will have no lasting effect on KEFs.

Changes to the functions, interests or activities of other users

The NWSTF is the only Commonwealth-managed fishery expected to be active within the PLET discharge location. Given the water depth of the full Trunkline discharge location (about 1400 m) and the temporary nature and rapid dilution of the discharge, impacts from the discharge of treated seawater such as changes to the functions, interest or activities of Commonwealth are unlikely.

Similarly, the hydrotest discharge of the smaller nearshore component near the State waters boundary overlaps the State-managed fisheries, however given the rapid dilution of the discharge and hence duration of exposure, impacts are considered unlikely. In the event of a wet buckle, the dispersal of dewatering fluids is likely to be temporary and disperse rapidly in the water column.

In general, given the oceanic locations and the localised and temporary nature of the contingent treated seawater discharges, exposure to fisheries is considered negligible.

Summary of Assessment Outcomes				
Receptor	**Impact**	**Receptor Sensitivity Level**	**Magnitude**	**Impact Significance Level / Risk Consequence**

Water quality	Change in water quality	Low value (open water)	Slight	Negligible (F)
Sediment quality	Change in sediment quality	Low value (open water)	Slight	Negligible (F)
Plankton	Injury/ mortality to fauna	Low value (open water)	No Lasting Effect	Negligible (F)
Epifauna and Infauna	Injury / mortality to fauna	Low value (open water)	No Lasting Effect	Negligible (F)
Fish	Injury/mortality or behavioural changes to marine fauna	High value species	No lasting effect	Slight (E)
Marine Mammals		High value species	No lasting effect	Slight (E)
Marine Reptiles		High value species	No lasting effect	Slight (E)
KEFs	Change in habitat	High value habitat	No lasting effect	Slight (E)
Overall Impact Significance Level: The overall impact significance level for routine and non-routine discharges from pre-commissioning and pipelay activities is E based on slight effect to high value receptors (marine fauna). The impact significance level for water quality is consistent with the level rated in the Scarborough OPP. Potential impacts to marine fauna have been additionally assessed in this EP. There is no change in magnitude of impact (no lasting effect).				

Demonstration of ALARP				
Control Considered	***Control Feasibility (F) and Cost/Sacrifice (CS)***	***Benefit in Impact/Risk Reduction***	***Proportionality***	***Control Adopted***
Legislation, Codes and Standards				
No additional controls identified				
Good Practice				
Chemicals will be selected with the lowest practicable environmental impacts and risks subject to technical constraints.	F: Yes. CS: Minimal cost. Standard practice.	Environmental assessment of chemicals in discharges 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 8.1**
Pipeline pre-commissioning procedures developed and followed including: • The volumes and concentrations of all inhibitor chemicals injected will be monitored and total chemical use will be measured.	F: Yes CS: Minimal cost, standard practice	Monitoring of chemical concentrations and volumes during FCGT will reduce the likelihood of prolonged undetected leaks and reduce the likelihood of over supply subsequently reducing associated toxicological effects in the receiving environment	Benefits outweigh cost/sacrifice	Yes **C 8.2**
A pipelay installation procedure will be in use which includes: • Alarm systems for dynamic positioning to indicate loss of vessel position. • A buckle monitoring system and certified anchor winch system will be in use.	F: Yes. CS: Minimal cost. Standard practice.	Pipelay installation procedures will reduce the likelihood of a wet buckle occurring that would require contingency dewatering.	Benefits outweigh cost/sacrifice.	Yes **C 8.3**

Demonstration of ALARP				
Control Considered	***Control Feasibility (F) and Cost/Sacrifice (CS)***	***Benefit in Impact/Risk Reduction***	***Proportionality***	***Control Adopted***
• Minimum tensioner alarms to ensure trunkline catenary is maintained. • Pipelay monitoring system.				
ROV inspection on commencement of hydrotest discharge at discahrge outlet, with onshore pressure monitoring throughout discharge	F: Yes. CS: Minimal cost. Standard practice.	Montioring during hydrotest discharge may increase identification of issues and reduce likelihood of problems going undetected for an extended period of time, ultimately having a potential to reduce environment impact of leaks, for example.	Benefits outweigh cost/sacrifice.	Yes **C 8.4**
Allow time (3 days) between pre-flooding/cleaning and hydrotest discharges to allow for concentrations to fall below defined 99% species protection level	F: Yes CS: Cost may be incurred depending on schedule	Avoids environmental concentration of additives becoming cumulative	Benefits outweigh cost/sacrifice.	Yes **C 8.5**
Professional Judgement - Eliminate				
No subsea discharges to be released to the marine environment	F: Not feasible. While the base case is for dry pre-commissioning of the trunkline, wet pre-commissioning must be retained as a contingency option to ensure verification of structural integrity is achieved. CS: Not considered, control not feasible.	Not considered – control not feasible.	Not considered – control not feasible	No
Onshore disposal of hydrotest water (full trunkline volume)	F: No. Not feasible due to large volume of treated seawater and unavailability of suitable storage / discharge location. CS: Not considered, control not feasible.	Not considered – control not feasible	Not considered – Control not feasible.	No
Onshore disposal of hydrotest water (State Waters component volume)	F: No. Not feasible due to large volume of treated seawater and unavailability of suitable storage / discharge location. Cannot be discharged to nearshore waters and	Not considered – control not feasible	Not considered – Control not feasible.	No

Demonstration of ALARP				
Control Considered	***Control Feasibility (F) and Cost/Sacrifice (CS)***	***Benefit in Impact/Risk Reduction***	***Proportionality***	***Control Adopted***
	impractical to relocate the large volume of water. CS: Not considered, control not feasible.			
Dry pre-commissioning of Trunkline to be progressed as base-case with FCGT /wet pre-commissioning only carried out as contingency	F: Yes. CS: Potential loss of production due to loss of integrity, possibly leading to a larger environmental incident if FCGT not carried out when required	Not carrying out wet pre-commissioning of FCGT would remove discharges of hydrotest water (treated seawater), which would reduce environmental impact potential	Benefits outweigh cost/sacrifice.	Yes **C 8.6**
Professional Judgement – Substitute				
No additional controls identified				
Professional Judgement – Engineered Solutions				
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 2.3.3**), Woodside considers the adopted controls appropriate to manage the impacts of FCGT fluid discharges. 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 Criteria and Assessment

The Petroleum Activities Program meets the acceptability criteria (**Section 2.3.5**):

- Overall impact significance level for water quality is consistent with the level rated in the Scarborough OPP. As discussed above, potential impacts to marine fauna have been additionally assessed in this EP. There is no change in magnitude of impact (no lasting effect); however, the impact significance level is slightly higher due to the higher receptor sensitivity level. This is not considered a significant change to the overall environmental impact and risk assessed in the Scarborough OPP.
- EPOs and controls in the Scarborough OPP that are relevant to routine and non-routine discharges have been adopted.
- There are no changes to internal/external context specific to this risk from the Scarborough OPP, including issues raised during stakeholder consultation.

Acceptability Statement:

The impact assessment has determined that, given the adopted controls, pre-commissioning and pipelay discharges are unlikely to result in an impact significance level greater than Slight. A number of BIAs for EPBC Act listed Threatened or Migratory species overlap the Trunkline Project Area, although no BIAs overlap the location of FCGT discharge at the PLET (refer to **Section 4.6**). The adopted controls are considered consistent with industry legislation, codes and standards, and professional judgement and meet the requirements of Australian Marine Orders.

The potential impacts are considered broadly acceptable if the adopted controls are implemented. Therefore, Woodside considers the adopted controls appropriate to manage the impacts of these discharges to a level that is broadly acceptable.

Environmental Performance Outcomes, Standards and Measurement Criteria			
EPO	***Adopted Control(s)***	***EPS***	***MC***
EPO 3 Undertake the Petroleum Activities Program in a manner that does not result in a substantial change in water quality which may adversely impact on biodiversity, ecological integrity, social amenity or human health. **EPO 6** Undertake the Petroleum Activities Program in a manner that will not modify, destroy, fragment, isolate or disturb an important or substantial area of habitat such that an adverse impact on marine ecosystem functioning or integrity results. **EPO 16** Undertake the Petroleum Activities Program in a manner that prevents a substantial adverse effect on a population of plankton including its life cycle and spatial distribution. **EPO 17** Undertake the Petroleum Activities Program in a manner which does not modify, destroy, fragment, isolate or disturb an important or substantial area of habitat such that an adverse impact on marine ecosystem functioning or integrity an area defined as a KEF. **EPO 18** Undertake the Petroleum Activities Program in a manner that prevents substantial change in sediment quality, that may adversely impact on biodiversity, ecological integrity, social amenity or human health.	**C 8.1** Chemicals will be selected with the lowest practicable environmental impacts and risks subject to technical constraints.	**PS 8.1** Reduces to ALARP the impact potential of all chemicals intended or likely to be discharged into the marine environment.	**MC 8.1.1** Records demonstrate chemical selection, assessment and approval process for selected chemicals is followed.
	C 8.2 Pipeline pre-commissioning procedures developed and followed including: • The volumes and concentrations of all inhibitor chemicals injected will be monitored and total chemical use will be measured.	**PS 8.2** Monitoring of chemicals injected confirms concentration in FCGT does not exceed 550ppm	**MC 8.2.1** Records of inhibitor chemicals injected and total chemical use.
	C 8.3 A pipelay installation procedure will be in use which includes: • Alarm systems for dynamic positioning to indicate loss of vessel position. • A buckle monitoring system and certified anchor winch system will be in use. • Minimum tensioner alarms to ensure trunkline catenary is maintained. • Pipelay monitoring system.	**PS 8.3** Pipelay installation procedure is in use during pipelay activities.	**MC 8.3.1** Records of pipelay installation procedure
	C 8.4 ROV inspection on commencement of hydrotest discharge at discharge outlet, with onshore pressure monitoring throughout discharge.	**PS 8.4** Monitoring of hydrotest discharge at commencement of release at outlet (by ROV) and throughout discharge (by Onshore pressure monitoring) undertaken	**MC 8.4.1** Evidence of monitoring
	C 8.5 Allow time (3 days) between pre-flooding/cleaning and hydrotest discharges to allow for concentrations to fall below threshold	**PS 8.5** 3 days (72 hrs) elapsed between pre-flooding /cleaning and hydrotest discharge if carried out	**MC 8.5.1** Records demonstrate time lapse between discharges
	C 8.6 Dry pre-commissioning of Trunkline to be progressed as base-case with FCGT	**PS 8.6** Dry pre-commissioning of Trunkline progressed as a base case to avoid	**MC 8.6.1** Records show dry pre-commissioning preference

Environmental Performance Outcomes, Standards and Measurement Criteria			
EPO	***Adopted Control(s)***	***EPS***	***MC***
	/wet pre-commissioning only carried out as contingency	hydrotest discharge, reducing environmental impact.	

6.7 Unplanned Activities (Accidents, Incidents, Emergency Situations)

6.7.1 Quantitative Spill Risk Assessment Methodology

Quantitative hydrocarbon spill modelling was performed by RPS (RPS, 2019, 2021), on behalf of Woodside, using a three-dimensional hydrocarbon spill trajectory and weathering model, SIMAP (Spill Impact Mapping and Analysis Program). The model is designed to simulate the transport, spreading and weathering of specific hydrocarbon types under different environmental conditions (both meteorological and oceanographic). Near-field subsurface discharge modelling was performed using OILMAP, which predicts the droplet sizes that are generated by the turbulence of the discharge as well as the centreline velocity, buoyancy, width and trapping depth (if any) of the rising gas and oil plumes. The OILMAP output parameters were used as input into SIMAP.

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

Stochastic modelling was conducted for this study, which compiled data from 100 hypothetical spills under different environmental conditions to determine the widest extent of possible oil dispersion. The environmental conditions for each of the hypothetical spills were selected randomly from an historic time-series of wind and current data representative of the study area. Results of the replicate simulations were then statistically analysed and mapped to define contours of percentage probability of contact at identified thresholds around the hydrocarbon release point.

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

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

In addition to the stochastic modelling, single-trajectory modelling (deterministic) was performed to assess potential worst-case trajectories based on the stochastic modelling runs. The deterministic simulations are therefore representative of single spill events under certain wind and current conditions. The deterministic simulations were performed to represent the fastest time to shoreline contact and the largest volume ashore from a single model run.

6.7.1.1 Worse Case Scenarios

In assessing the potential impacts of an unplanned hydrocarbon release, representative worst-case scenarios (in terms of volume and location) were assessed. A summary of the credible hydrocarbon spill scenarios that could occur during the Petroleum Activities Program are provided in **Table 6-16**.

Table 6-16: Credible hydrocarbon spill scenarios

Scenario		Hydrocarbon type	Maximum credible volume	Location
1	Hydrocarbon release due to vessel collision. Refuelling tanker or PV is governing scenario.	Marine diesel	2000 m^3	Any location within Operational Area
2	Bunkering loss of containment. Hose failure is governing scenario.	Marine diesel	55 m^3	Within Operational Area
3	Release from onboard equipment. PV HPU is governing scenario.	Hydraulic fluid	8 m^3	Within Operational Area

For the Petroleum Activities Program, the worst-case scenario was identified to be an instantaneous surface release of 2,000 m^3 of marine diesel, representing loss of the largest vessel fuel tank integrity (construction vessel) following a collision. As the worst-case scenario, the assessment of impacts will also address the potential impacts of other credible lesser releases.

To inform the impact assessment, quantitative hydrocarbon spill modelling was undertaken for the worst-case hydrocarbon release scenario (RPS, 2019, 2021).

It is not practicable for spill modelling to be undertaken at every potential release location within the Operational Area. Release locations were selected by considering locations that would:

- have the greatest potential environmental consequence to the receiving environment (closest to sensitive receptors) and / or
- be considered at greater risk of a spill event.

Accordingly, a release of marine diesel was modelled at three representative locations; two along the trunkline at sensitive locations, and one at the end of the trunkline (FPU) (**Table 6-17**), these are also shown in **Figure 4-1**. The Hydrocarbon EMBA has been defined using a combination of all three locations.

Table 6-17: Spill locations for 2000 m^3 marine diesel instantaneous release

Location	Coordinates	Water Depth
Location 1: Outside Mermaid Sound	20° 21' 3.28" S, 116° 42' 5.58" E	31 m
Location 2: Within the Montebello Australian Marine Park	20° 03' 1.44" S, 115° 31' 35.04" E	74 m
Location 3: FPU / end of trunkline	19° 53' 54.72" S; 113° 14' 19.56" E	930 m

6.7.1.2 Hydrocarbon Characteristics

Marine diesel is characterised by a large mixture of low- and semi- to low-volatile compounds (95%) and persistent hydrocarbons (5%). Additionally, marine diesel typically contains less than 3% aromatic hydrocarbons that could potentially dissolve in the water column. MDO has been selected for modelling as it represents a worst case outcome; vessels as part of the PAP will not use HFO or IFO.

Table 6-18 summarises hydrocarbon characteristics of marine diesel.

Table 6-18: Characteristics of marine diesel

Physical Properties	Result
Density (kg/m³)	829 (at 25 °C)
American Petroleum Institute (API)	37.2
Dynamic viscosity (centipoises; cP)	4 (at 25 °C)
Pour Point (°C)	-7
Gas to condensate ratio (bbl/MMscf)	N/A
Oil Property Category	II
Oil Persistence Classification	Non-persistent

6.7.1.3 Environment that May Be Affected and Hydrocarbon Contact Thresholds

The outputs of the quantitative hydrocarbon spill modelling are used to assess the environmental risk, if a credible hydrocarbon spill scenario occurred, by delineating which areas of the marine environment could be exposed to hydrocarbon levels exceeding hydrocarbon threshold concentrations.

The summary of all the locations where hydrocarbon thresholds could be exceeded by any of the simulations modelled is defined as the Hydrocarbon EMBA which is driven by the worst-case credible hydrocarbon spill scenario, which in this instance is the loss of 2000 m^2 (modelled volume) in the event of a vessel collision resulting in a fuel tank rupture. As described in **Section 4.1**, the Hydrocarbon EMBA also is used to define the EMBA (**Figure 4-1**), which includes the dredging Zone of Influence (**Section 6.6.2)**. The Hydrocarbon EMBA has been defined using a combination of all three modelling locations.

As the weathering of different fates of hydrocarbons (surface, entrained and dissolved) differs due to the influence of the metocean mechanism of transportation, the Hydrocarbon EMBA combines the potential spatial extent of the different fates. It is noted that the hydrocarbon thresholds used to define the EMBA for this Petroleum Activities Program are more conservative than the thresholds adopted in the Scarborough OPP (SA0006AF0000002, Rev 5) (Section 7.2.6). Consequently, the EMBA for this activity is larger than the EMBA defined in the Scarborough OPP.

The Hydrocarbon 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 (100-200 simulations in total). The Hydrocarbon EMBA therefore represents the total extent of all the locations where hydrocarbon thresholds could be exceeded from all modelling runs.

Surface and accumulated shoreline hydrocarbon concentrations are expressed as grams per square metre (g/m²), with entrained and dissolved aromatic hydrocarbon concentrations expressed as parts per billion (ppb). A conservative approach adopting accepted contact thresholds that are documented to impact the marine environment are used to define the Hydrocarbon EMBA. These hydrocarbon thresholds are presented in **Table 6-19** and described in the following subsections.

Woodside recognises that hydrocarbons may be visible beyond the Hydrocarbon EMBA at lower concentrations than the ecological impact thresholds defined in **Table 6-19**. The threshold for visible surface oil (1 g/m^2) has therefore been used to define an additional boundary within which socio-cultural impacts to the visual amenity of the marine environment may occur. This area is referred to as the socio-cultural EMBA. Any ecological impacts from dissolved and entrained hydrocarbons above prescribed thresholds, as in **Table 6-19**, may also result in socio-cultural impacts. Potential impacts to socio-cultural values assessed within these EMBAs include:

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

Table 6-19: Summary of environmental impact thresholds applied to the quantitative hydrocarbon spill risk modelling results

Hydrocarbon Type	EMBA				Socio-cultural EMBA
	Surface Hydrocarbon (g/m²)	Entrained hydrocarbon (ppb)*	Dissolved aromatic hydrocarbon (ppb)*	Accumulated hydrocarbon (g/m²)	Surface Hydrocarbon (g/m²)
Marine Diesel	10	100	50	100	1

** Hydrocarbon thresholds used to define the EMBA for this Petroleum Activities Program are more conservative than the thresholds adopted in the Scarborough OPP (SA0006AF0000002, Rev 5) (Section 7.2.6). Consequently, the EMBA for this activity is larger than the EMBA defined in the Scarborough OPP.*

6.7.1.4 Surface Hydrocarbon Threshold Concentrations

The spill modelling outputs defined the EMBA for surface hydrocarbons resulting from a spill (contact on surface waters) using a threshold of ≥10 g/m² for diesel. This is equivalent to dull metallic colours based on the relationship between film thickness and appearance (Bonn Agreement, 2015) (**Table 6-20**). This threshold concentration is geared towards informing potential oiling impacts for wildlife groups and habitats that may break through the surface slick from the water or the air (for example: emergent reefs, vegetation in the littoral zone and air-breathing marine reptiles, cetaceans, seabirds and migratory shorebirds).

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

A lower concentration of 1 g/m², which represents a rainbow sheen on the surface (**Table 6-20**), has also been used to define a wider area within which socio-cultural impacts to the visual amenity of the marine environment may occur. This wider area is referred to as the 'socio-cultural EMBA'.

Table 6-20: The Bonn Agreement oil appearance code

Appearance (following Bonn visibility descriptors)	Mass per area (g/m²)	Thickness (µm)	Volume per area (L/km²)
Discontinuous true oil colours	50 to 200	50 to 200	50,000 to 200,000
Dull metallic colours	5 to 50	5 to 50	5000 to 50,000
Rainbow sheen	0.30 to 5.00	0.30 to 5.00	300 to 5000
Silver sheen	0.04 to 0.30	0.04 to 0.30	40 to 300

6.7.1.5 Accumulated Hydrocarbon Threshold Concentrations

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

6.7.1.6 Dissolved Aromatic Hydrocarbon Threshold Concentrations

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).

6.7.1.7 Entrained Hydrocarbon Threshold Concentrations

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.

This threshold is used to define an area within which ecological impacts to the marine environment may occur from entrained hydrocarbons. Therefore, it may also be associated with socio-cultural impacts.

6.7.1.8 Scientific Monitoring

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

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

6.7.2 Unplanned Hydrocarbon Release – Vessel Collision

Scarborough OPP – Relevant Impact Assessment Section		
Section 7.2.6 – Unplanned Hydrocarbon Release		
Context		
Relevant Activities Vessel Operations – **Section 3.11.2**	**Existing Environment** Physical Environment – **Section 4.4** Habitats and Biological Communities – **Section 4.5** Protected Species – **Section 4.6** Protected Places – **Section 4.8** Socio-economic values – **Section 4.9**	**Stakeholder consultation** Consultation – **Section 5** No stakeholder concerns have been raised with respect to hydrocarbon spills or potentially impacted receptors.

Impact/Risk Evaluation Summary

Source of Impact/Risk	***Environmental Value Potentially Impacted***							***Evaluation***						
	Soil and Groundwater	**Marine Sediment**	**Water Quality**	**Air Quality (inc. odour)**	**Ecosystems / Habitat**	**Species**	**Socio-economic**	**Decision Type**	**Impact/Consequence**	**Likelihood**	**Current Risk Rating**	**ALARP Tools**	**Acceptability**	**Outcome**
Loss of hydrocarbons to marine environment due to a vessel collision			✓		✓	✓	✓	A	B	1	M	LCS GP PJ	Acceptable if ALARP	EPO 19

Description of Source of Impact/Risk

Background

The temporary presence of the 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 project vessels which could result in a loss of containment.

Project vessels (as described in **Section 3**) typically have multiple isolated tanks and the largest volume of a single tank for these types of vessels is in the order of 250 m3 (for survey vessels, support vessels and pipe transport vessels) to 2000 m^3(for a refuelling vessel). Tank locations are midship (not bow or stern). It was determined that the maximum single tank capacity of these project vessels used for the Petroleum Activities Program is 2000 m^3 (**Table 6-16**).

Some vessels are able to operate on either heavy fuel oil (HFO) or marine diesel, however for this PAP vessels will not use heavy fuel oil or intermediate fuel oil (IFO).

In the highly unlikely event of a collision event during the Petroleum Activities Program, as described above, the vessel 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 to -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 contamination occurred. The second 2010 vessel collision involved a vessel under pilot control in port connected with a vessel alongside a wharf causing it to sink. No reported contamination 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 occurring.

From 2010 to 2011, the ATSB's annual publication defines the individual safety action factors identified in marine accidents and incidents: 42% related to navigation action (2011). Of those, 15% related to poor communication and 42% related to poor monitoring, checking and documentation. 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 undertaken 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 6-16**). The scenarios considered damage to single and multiple fuel storage tanks in the vessel due to various combinations of vessel to vessel collisions. In summary:

- It is not a credible scenario that the total storage volume of the project vessel would be lost, as fuel is stored in more than one tank. Credible spill volumes are calculated as per AMSA recommendations (AMSA, 2015)
- It is highly unlikely that the full volume of the largest storage tank on a project vessel would be lost.

A collision between a project vessel with a third party vessel (i.e., commercial shipping/fisheries) at any location within the Operational Area was assessed as being credible. However, this is highly unlikely given the standard vessel operations and equipment in place to prevent collision at sea, the short duration of activities in the Operational Area, the typical low speeds of vessels undertaking the Petroleum Activities Program and the construction and placement of storage tanks. Potential spill volumes for this scenario are summarised in Table **6**-**21**.

A collision between project vessels within the PAP was considered credible, however it is not credible that the collision would meet the loss of containment conditions listed above (i.e., vessel speed, location etc.) to cause a failure of fuel storage tank(s).

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

Table 6-21: Summary of credible hydrocarbon spill scenario as a result of vessel collision

Scenario	Hydrocarbon Volumes	Preventative and Mitigation Controls	Credibility
Loss of containment from a project vessel resulting from a collision with the PV (or two vessels operating within the PAP)	Largest worst-case volume of a single tank is 2000 m^3. This is representative of either a refuelling tanker or the PV, and the largest fuel tank of all other vessels is expected to be smaller than this.	Operational procedures and practises such as reduced vessel speeds in proximity to the PV, SIMOPS plans where different work scopes operating near each other and validation of vessel master/crew competency and training.	**Not Credible.** While collision between PAP vessels is credible, such as a bunkering vessel with the PV, it is not credible that the collision would be of sufficient energy to cause fuel tank rupture and result in a loss of containment.
Loss of containment from a project vessel (as described in **Section 3**) resulting from a collision with a third-party vessel.	Largest worst-case volume of a single tank is 2000 m^3. This is representative of either a refuelling tanker or the PV, and the largest fuel tank of all other vessels is expected to be smaller than this.	Typically double wall, tanks which are located mid-ship (not bow or stern). Vessels are not anchored (with the possible exception of the SWLB) and move at low speeds when relocating within the Operational Areas or providing stand-by cover. Normal maritime procedures would apply during such vessel movements.	**Credible** Project vessel – third party vessel collision could potentially result in the release from a fuel tank.

Quantitative Hydrocarbon Risk Assessment

Modelling of a 2000 m^3 surface release of marine diesel was undertaken for three locations within the Trunkline Project Area (refer to **Table 6-17** for a summary of spill release locations) (RPS 2019, 2021).

The modelling assessed the extent of a marine diesel spill volume of 2000 m^3 for all seasons, using an historic sample of wind and current data for the region. The modelling was conducted by RPS using a three-dimensional hydrocarbon spill trajectory and weathering model, updated in 2021 (SIMAP, Spill Impact Mapping and Analysis Program) (RPS, 2019, 2021). The model ran 100-200 annualised spill trajectories, varying the start time (and hence prevailing wind and current conditions). This approach ensures that the predicted transport and weathering of a hydrocarbon slick is subjected to a range of oceanic conditions.

Hydrocarbon Characteristics

MDO is a non-persistent fuel oil and contains a small proportion of heavy components (or low volatile components) that tend to physically entrain into the upper water column in the presence of moderate winds (i.e. >12 knots) and breaking waves but may re-float to the surface if these conditions abate. In the event of a substantial spill, the heavier components can remain entrained or remain on the sea surface for an extended period. The characteristics of the marine diesel are given in **Table 6-22**.

When spilt into the warm tropical and subtropical marine environment expected, MDO spreads rapidly and forms a very thin slick, with most of the volatile components typically evaporating in less than a day. Approximately 41% by mass of this oil is predicted to evaporate over the first couple of days depending on the prevailing wind conditions, with further evaporation slowing over time. The heavier (low volatility) components of the oil tend to entrain into the upper water column due to wind-generated waves, but can subsequently resurface depending on conditions (RPS, 2019, 2021).

RPS conducted weathering simulations to illustrate the potential behaviour of MDO when exposed at the water's surface under constant (5 knots) and variable wind conditions (**Figure 6-6** and **Figure 6-7**). Variable wind conditions generate greater entrainment of the hydrocarbon in the water column. Approximately 24 hours after the spill, around 45% of the oil mass is forecast to have entrained and a further 36% is forecast to have evaporated, leaving only a small proportion of the oil floating on the water surface (<1%).The residual compounds will tend to remain entrained beneath the surface under conditions that generate wind waves (approximately >6 m/s).

Variable wind does result in a higher percentage of biological and photochemical degradation, with an approximate rate of 1.8% per day. Whereas the constant wind scenario shows ~50% of the oil evaporates within 36 hours with negligible entrainment, but with a rate of only ~0.2% degradation per day.

Table 6-22: Characteristics of the marine diesel

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

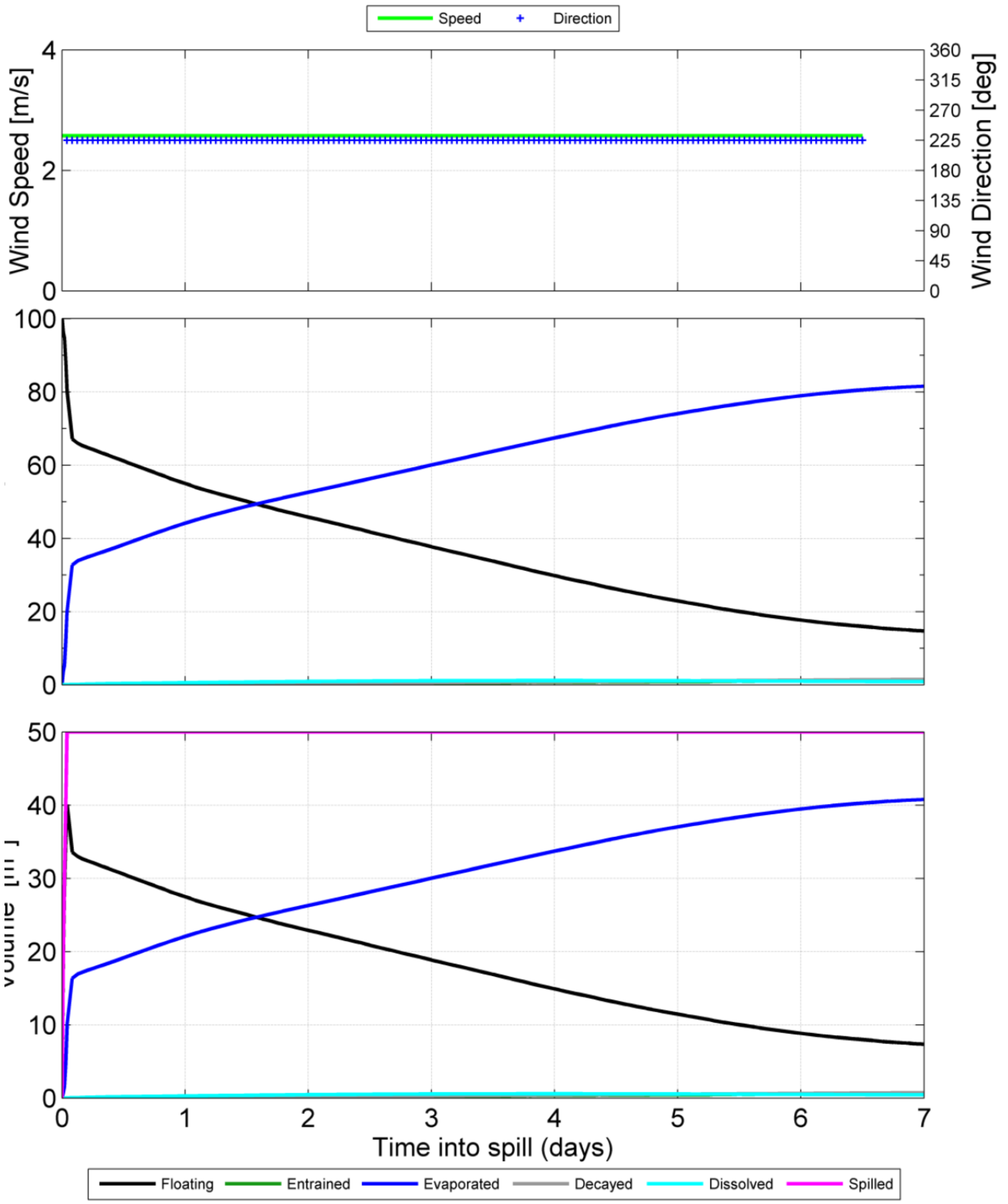


Figure 6-6: Mass balance plot representing, as proportion (middle panel) and volume (bottom panel), the weathering of marine diesel spilled onto the water surface as a one-off release (50 m^3 over 1 hour) and subject to a constant 5 kn (2.6 m/s) wind at 27 °C water temperature and 25 °C air temperature.

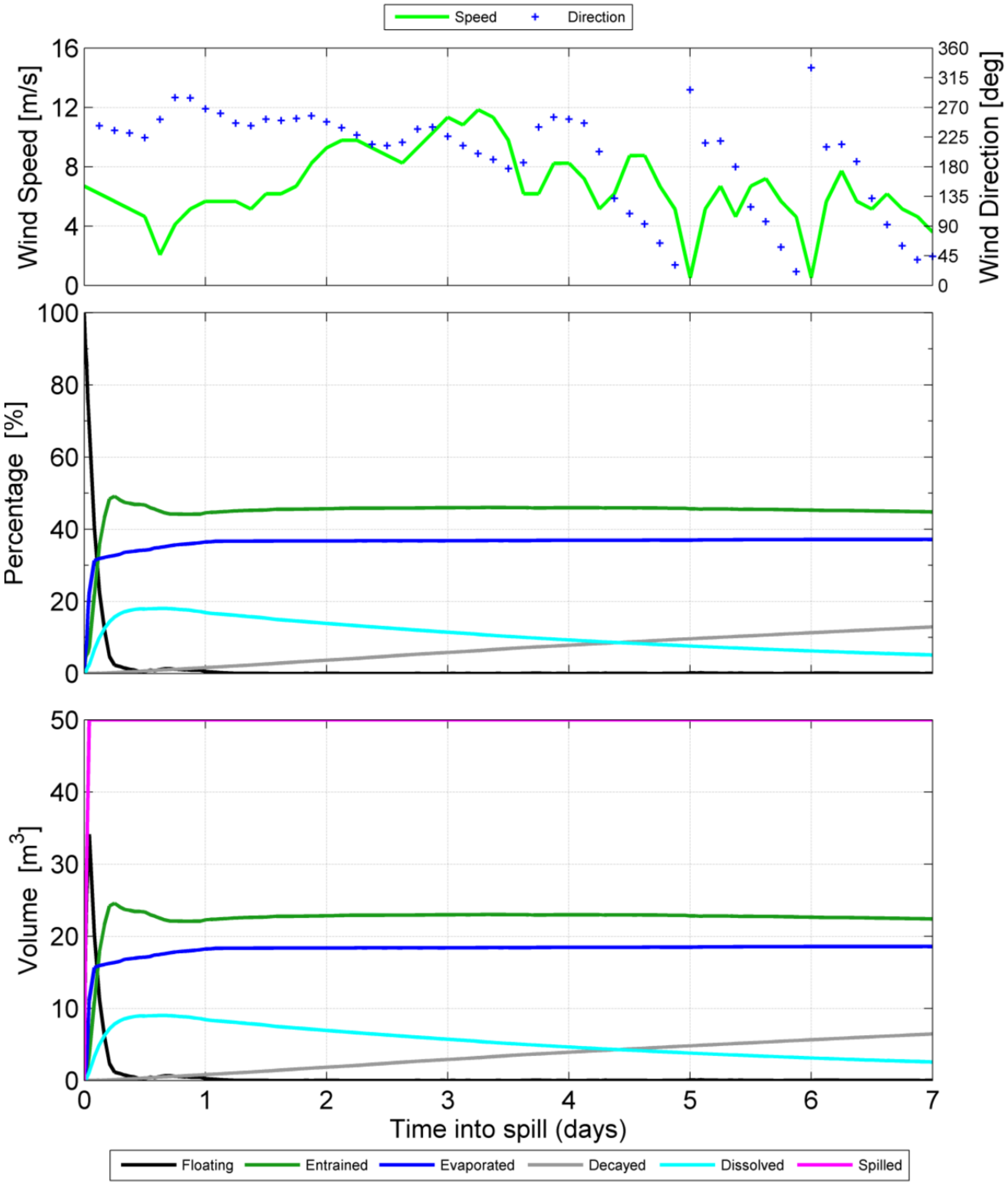


Figure 6-7: Mass balance plot representing, as proportion (middle panel) and volume (bottom panel), the weathering of marine diesel spilled onto the water surface as a one-off release (50 m^3 over 1 hour) and subject to variable wind at 27 °C water temperature and 25 °C air temperature.

Detailed Impact Assessment
Assessment of Potential Impacts

Environment that May Be Affected

The Hydrocarbon EMBA for the Petroleum Activities Program is based on stochastic modelling which compiles data from 100-200 hypothetical worst-case spills under a variety of weather and metocean conditions (as described in **Section 6.7.1)** (RP, 2019, 2021). The EMBA therefore covers a larger area than the area that would be affected during any one single spill event, and therefore represents the total extent of all the locations where hydrocarbon thresholds could be exceeded from all modelling runs. The trajectory of a single spill would have a considerably smaller footprint.

As described in **Section 6.7.1**, three hydrocarbon spill locations were modelled in order to represent the range of locations of where vessel collision could occur within the Operational Area (refer to **Table 6-17**). The EMBA has been defined using a combination of all three locations, as shown in **Figure 4-1** the largest extent of the Hydrocarbon EMBA is based on the entrained threshold from the modelled locations.

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 discussed for each fate.

Surface Hydrocarbons

Modelling of surface hydrocarbons from Location 1 (outside Mermaid Sound) indicates that concentrations equal to or greater than the 10 g/m² threshold could potentially be found up to 29 km from the spill site. Dampier Archipelago (2% probability), Dampier Marine Park (2% probability) and WA Coastline (3% probability) are predicted to receive floating oil at concentrations equal to or greater than 10 g/m².

Modelling of surface hydrocarbons from Location 2 (Montebello AMP) indicates that concentrations equal to or greater than the 10 g/m² threshold could potentially be found up to 39 km from the spill site. Given that this spill location lies within the Montebello AMP receptor area, floating oil at concentrations equal to or greater than 100 g/m² are forecast with a probability of 100%. Probabilities of floating oil contact at the 10 g/m² threshold are forecast to be less than 1% for all other shoreline receptors.

Modelling of surface hydrocarbons from Location 3 (FPU/end of trunkline) indicates that concentrations equal to or greater than the 10 g/m² threshold could potentially be found up to 113 km from the spill site. No shoreline receptors are predicted to be contacted by surface hydrocarbons concentrations. Floating oil at the 10 g/m² threshold is predicted to arrive at the surface waters of the Gascoyne Marine Park receptor with a probability of 1% after 64 hours.

Accumulated Hydrocarbons

Potential for accumulation of oil on shorelines is predicted to be low from a spill at Location 1 (outside Mermaid Sound), with a maximum accumulated volume of 3 m³ and a maximum local accumulated concentration on shorelines of 156 g/m² forecast at Dampier Archipelago and a probability of 1% above the ecological threshold concentration (100 g/m²).

Accumulated hydrocarbons above threshold concentrations (≥100 g/m²) were not predicted by the modelling to occur from a spill at Location 2 (Montebello AMP) or Location 3 (FPU/end of trunkline).

Entrained Hydrocarbons

Entrained oil at concentrations equal to or greater than the 100 ppb threshold is predicted to be found up to around 414 km from a spill at Location 1 (outside Mermaid Sound). The Dampier Marine Park (54%), Dampier Archipelago (51%), Montebello Islands (8%), Muiron Islands MMA-WHA (2%), Pilbara – Middle (Islands and Shoreline, 5%), Pilbara Islands – Northern (Islands and Shoreline, 7%), Montebello Marine Park (12%), Montebello State Marine Park (8%), Muiron Islands (2%), Eighty Mile Beach (1%), Gascoyne Marine Park (2%) and WA Coastline (51%) receptors are predicted to receive entrained oil concentrations at the 100 ppb threshold with probabilities in parenthesis, respectively. The maximum entrained oil concentration is forecast as 10,911 ppb within the Dampier Archipelago.

Entrained oil at concentrations equal to or greater than the 100 ppb threshold is predicted to be found up to around 630 km from a spill at Location 2 (Montebello AMP). The following receptors are predicted to receive entrained oil concentrations at the 100 ppb threshold with probabilities in parenthesis: Montebello Marine Park (78%), Muiron Islands Marine Management Area – World Heritage Area (MMA-WHA, 13%), Argo-Rowley Terrace MP (1%), Barrow Island (5%), Montebello Islands (8%), Ningaloo Coast (Middle, Middle WHA, North, North WHA, max. 12%), Ningaloo RUZ (12%), Pilbara Islands – Southern Island Group (5%), Ranking Bank (1%), Shark Bay (Open Coast and WHA, 1% and 1%, respectively), Bernier & Dorre Islands (1%), Lowendal Islands (1%), Montebello State Marine Park (13%), Muiron Islands (11%), Gascoyne Marine Park (11%) and WA Coastline (10%). The maximum entrained oil concentration is forecast as 156,954 ppb within the Montebello Marine Park.

Entrained oil at concentrations equal to or greater than the 100 ppb threshold is predicted to be found up to around 918 km from a spill at Location 3 (FPU/end of trunkline). The Gascoyne Marine Park, Carnarvon Canyon Marine Park and Abrolhos Islands Marine Park receptors are predicted to receive entrained oil concentrations at the 100 ppb threshold with a probability of 10%. 1% and 1%, respectively. The maximum entrained oil concentration is forecast as 7236 ppb within the Gascoyne Marine Park.

Dissolved Hydrocarbons

Dissolved aromatic hydrocarbons at concentrations equal to or greater than the 50 ppb threshold are predicted to be found up to around 90 km from a spill at Location 1 (outside Mermaid Sound). Dissolved aromatic hydrocarbons at concentrations equal to or greater than the 50 ppb threshold are predicted at Dampier Archipelago (probability 15%), Dampier Marine Park (probability 24%) and the WA Coastline (probability 15%), with a maximum dissolved aromatic hydrocarbon concentration forecast of 635 ppb.

Dissolved aromatic hydrocarbons at concentrations equal to or greater than the 50 ppb threshold are predicted to be found up to around 216 km from a spill at Location 2 (Montebello AMP). Barrow Island (probability 1%), Montebello Islands (probability 1%), Ranking Bank (probability 1%), Montebello Marine Park (probability 49%), Montebello State Marine Park (probability 1%) and the WA Coastline (probability 1%) are receptors predicted to receive dissolved aromatic hydrocarbon concentrations at the 50 ppb threshold. The maximum dissolved aromatic hydrocarbon concentration is forecast as 1990 ppb within the Montebello Marine Park.

Dissolved aromatic hydrocarbons at concentrations equal to or greater than the 50 ppb threshold are predicted to be found up to around 244 km from a spill at Location 3 (FPU/end of trunkline). The Gascoyne Marine Park is the only receptor predicted to receive dissolved aromatic hydrocarbon concentrations at the 50 ppb threshold with a probability of 3%. The maximum dissolved aromatic hydrocarbon concentration is forecast as 462 ppb within the Gascoyne Marine Park.

Water Quality

An unplanned release of marine diesel, would result in a change in water quality, affecting the ambient water quality within the Hydrocarbon EMBA as follows:

- The highly-mixed, open water location and characteristics of marine diesel will result in rapid evaporation and dispersion.
- Water quality would be reduced and is predicted to be at or above biological effect concentrations for the surrounding marine waters over the Montebello Marine Park. The submerged Tryal Rocks (30-40 m depth) within the Montebello Marine Park has the potential to be exposed to entrained hydrocarbons at or greater than 100 ppb. The waters surrounding this submerged habitat would show a reduction in quality due to hydrocarbon contamination above background and/or national/international quality standards.
- Exposure to significant habitats will be at low levels such that no significant habitats or ecosystem function or integrity will be impacted (as discussed in the receptor sections).

Plankton

Injury/mortality to planktonic species may occur due to a change in water quality following an unplanned hydrocarbon release as follows:

- Plankton in contact with the spill source at the time of release may be impacted, and there is potential for localised mortality.
- Given hydrocarbon characteristics, expected rapid weathering and then degradation of the entrained component, and the relatively quick recovery times of plankton, unplanned marine diesel releases are not expected to have a substantial adverse effect on plankton life cycle and spatial distribution.

Fish, Sharks and Rays

Injury/mortality to fish species may occur due to a change in water quality following an unplanned hydrocarbon release as follows:

- While fish and sharks do not generally break the sea surface, individuals may feed at the surface for a short period. Marine diesel is expected to quickly disperse and evaporate, limiting the exposure.
- Fishes are more susceptible to the effects of spilled oil (particularly entrained and dissolved) in their early life stages, particularly during egg and planktonic larval stages, which can become entrained in spilled oil. Effects will be greatest in the upper 10 m of the water column where hydrocarbon concentrations are higher.
- Impacts to sharks and rays may occur through direct contact with hydrocarbons and contaminate the tissues and internal organs, either through direct contact or via the food chain (consumption of prey). As gill breathing organisms, sharks and rays may be vulnerable to toxic effects of dissolved hydrocarbons (entering the body via the gills) and entrained hydrocarbons (coating of the gills inhibiting gas exchange).
- More subtle, chronic effects on the life history of fishes may occur due to early life stage exposure. Effects may include disruption to complex behaviour such as predator avoidance, reproductive and social behaviour (Hjermann et al., 2007).
- Adult fishes exposed to low hydrocarbon concentrations are likely to metabolise the hydrocarbons and excrete the derivatives, with studies showing that fishes can metabolise petroleum hydrocarbons and that accumulated hydrocarbons are released from tissues when the fish is returned to hydrocarbon-free sea water.
- A BIA for whale shark foraging overlaps the Operational Area between KP 72 and KP 199, as well as the EMBA. Whale sharks may transit offshore open waters when migrating to and from Ningaloo Reef, where they aggregate for feeding from March to July. Whale sharks are versatile feeders, filtering large amounts of water over their gills, catching planktonic and nektonic organisms (Jarman and Wilson, 2004). It is therefore possible that surface and/or entrained hydrocarbon and/or dissolved aromatic hydrocarbon could come in contact with, or be ingested by whale sharks migrating or aggregating in the area at the time of release

Marine Mammals

A change in marine fauna behaviour or injury/mortality to marine mammals may occur due to a change in water quality after an unplanned hydrocarbon release as follows:

- A range of marine mammal species were identified as potentially occurring within the Operational Area and EMBA (**Section 4.6.3**).
- BIAs of marine mammals listed as MNES overlap the Trunkline Project Area, including humpback whales (migration and resting BIAs) and pygmy blue whales (northbound and southbound migrations). BIAs of MNES listed marine mammals also overlap the EMBA (**Section 4.6.3**), including humpback whales (migration and resting BIAs), dugongs (foraging and breeding, nursing, calving BIAs) and pygmy blue whales (northbound and southbound migrations, distribution and foraging BIAs).
- Humpback and/or pygmy blue whale populations may be impacted if the hydrocarbon release occurs during the seasonal migration periods. Such disruption could include behavioural impacts (e.g. avoidance of impacted areas), sub-lethal biological effects (e.g. skin irritation, irritation from ingestion or inhalation, reproductive failure) and, in rare circumstances, death.
- Dugongs may be indirectly impacted via habitat loss due to reduction in seagrass due to from contact with entrained hydrocarbons. Direct impacts to dugongs could occur through foraging or ingesting seagrass coated with hydrocarbon.
- Marine mammals may come in direct contact with hydrocarbons should they surface within the slick. Impacts to the species can include irritation of eyes/mouth and potential illness from hydrocarbon ingestion.
- Entrained and dissolved hydrocarbons may lead to sub-lethal physical and toxic effects, such as irritation and illness. The likelihood of toxic effects occurring is increased closer to the release location.
- Although potential impacts could include mortality or sub-lethal injury/illness of marine mammals, this is expected to comprise a small proportion of the resident and transitory population. Given hydrocarbon characteristics, expected rapid weathering of surface oil to below impact thresholds, and the mobile transient nature of marine mammals and potential avoidance behaviour, unplanned releases of marine diesel are not expected to have a substantial adverse effect on the population, or spatial distribution of marine mammals; or substantially modify, destroy or isolate an area of important habitat for migratory species.
- Conservation advice for some marine mammal species identify noise interference and vessel disturbance as key threats. While hydrocarbon spills are not explicitly identified as a threat, conservation advice for the sei whale does include the management of physical disturbance and development activities. No explicit management actions are identified relevant to hydrocarbon spills.

Marine Reptiles

A change in marine fauna behaviour or injury/mortality to marine reptiles may occur due to direct contact or a change in water quality leading to indirect impacts following an unplanned hydrocarbon release as follows:

- Flatback, green, loggerhead and hawksbill turtle internesting BIAs overlap the Trunkline Project Area and EMBA (Section 4.6.2). Flatback, green and hawksbill turtles also have internesting habitat critical overlapping with the Trunkline Project Area, particularly, for the Dampier Archipelago.
- Hydrocarbons in surface waters may impact turtles when they surface to breathe and inhale toxic vapours.
- Contact with entrained hydrocarbons can result in hydrocarbon adherence to body surfaces, irritating mucous membranes in the nose, throat and eyes, leading to inflammation and infection (Gagnon and Rawson, 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).
- Turtles within shallow coastal waters may be impacted as they feed in shallow water coral and macroalgae habitats, and therefore, may ingest hydrocarbons.
- Accumulated hydrocarbons on shorelines could impact marine fauna that utilise beaches including marine turtles, dependent upon the timing of a release. However volumes of accumulated hydrocarbons are low.
- Although potential impacts could include mortality or sub-lethal injury/illness of marine reptiles, this is expected to comprise a small proportion of the resident and transitory population. Given hydrocarbon characteristics, expected rapid weathering to below impact thresholds, and the mobile transient nature of individuals, unplanned hydrocarbon releases are not expected to substantially modify, destroy or isolate an area of important habitat for migratory species.

Seabirds and Migratory Shorebirds

Change in marine fauna behaviour or injury/mortality to seabirds and migratory shorebirds may occur due to a change in water or sediment quality following an unplanned hydrocarbon release as follows:

- Breeding and foraging BIAs for EPBC listed seabird species that overlap the EMBA may be impacted by a hydrocarbon release (**Section 4.6.4**).

- Seabirds and migratory shorebirds are particularly vulnerable to contact with surface hydrocarbons, which may mat feathers, leading to hypothermia from loss of insulation and ingestion of hydrocarbons when preening to remove hydrocarbons. Both impacts may result in mortality (Hassan and Javed, 2011).
- Lethal or sub-lethal physical and toxic effects may occur to seabirds, including irritation of eyes/mouth and potential illness.
- It is commonly thought that marine diesel does not cause problems for wildlife due to the lack of visible oiling, however may be toxic (WAOWRP, 2014). 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).
- Shorebirds may encounter accumulating hydrocarbons on shorelines at feeding, roosting and breeding sites. The risk of impact is greater should an unplanned hydrocarbon release occur within the chick-rearing period, where adults forage closer to breeding colonies.
- Although potential impacts could include mortality or sub-lethal injury/illness of birds, this is expected to comprise a small proportion of the resident and transitory population. Given hydrocarbon characteristics, expected rapid weathering to below impact thresholds, and the mobile transient nature of individuals, unplanned hydrocarbon releases are not expected to substantially modify, destroy or isolate an area of important habitat for migratory species.

Coral

A change in habitat may occur due to a change in water or sediment quality following an unplanned hydrocarbon release as follows:

- Significant areas of coral are known to occur fringing the Dampier Archipelago, (such the outer islands of Legendre etc), Montebello Islands, Rankin Bank, Barrow Island, Lowendal Islands, the Ningaloo Coast and Muiron Islands, Shark Bay outer islands of Bernier & Dorre Islands, all within the EMBA.
- Exposure to entrained hydrocarbons (≥100 ppb) has the potential to result in lethal or sub-lethal toxic effects to corals and other sensitive sessile benthos within the upper water column, including upper reef slopes (subtidal corals) and reef flat (intertidal corals).
- Sub-lethal 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).
- Should a hydrocarbon release occur at the time of coral spawning (at potentially affected coral locations), there is the potential for a significant reduction in successful fertilisation and coral larval survival, due to the sensitivity of coral in early life stages to hydrocarbons (Negri and Heyward, 2000).

Seagrass and Macroalgae

A change in habitat may occur due to a change in water or sediment quality following an unplanned hydrocarbon release as follows:

- Seagrass and macroalgae communities are found in shallow waters surrounding islands of the Dampier Archipelago, Barrow Island, Lowendal Islands, Muiron Islands, Pilbara Islands, Bernier and Dorre Islands, Montebello Islands as well as Eighty Mile Beach AMP, Ningaloo Coast North/North WHA and South/South WHA and RUZ and Shark Bay Open Ocean Coast. Modelling predicts that both Dampier and Montebello marine parks are predicted to be intersected with entrained hydrocarbons over the exposure thresholds (RPS, 2019, 2021). In particular, the Montebello Marine Park has a 78% probability, with high concentrations of entrained hydrocarbons. This is to be expected, as the release location modelled is within the marine park boundaries.
- Exposure to entrained hydrocarbons may result in mortality of seagrass and macroalgae, depending on actual entrained aromatic hydrocarbon concentrations received and duration of exposure. Physical contact with entrained hydrocarbon droplets could cause sub lethal stress, causing reduced growth rates and reduced tolerance to other stress factors.
- Seagrass and macroalgal beds in the intertidal and subtidal zone may be susceptible to impacts from entrained hydrocarbons. Toxicity effects can also occur due to absorption of soluble fractions of hydrocarbons into tissues.

Mangroves

A change in habitat may occur due to a change in water or sediment quality following an unplanned hydrocarbon release as follows:

- Modelling predicts that there is 1% probability of shorelines being contacted over the exposure threshold for any release location at WA Coastline and Dampier Archipelago, with the maximum local volume predicted to accumulate of 3 m^3. Both shorelines include some areas of mangroves (RPS, 2019, 2021).
- Mangroves are considered to have a high sensitivity to hydrocarbon exposure.

- Mangroves can be impacted by heavy or viscous oil, or emulsification, that covers the trees breathing pores thereby asphyxiating the subsurface roots, which depend on the pores for oxygen (IPIECA, 1993).
- Hydrocarbons deposited on the aerial roots can block the pores used to breathe, or interfere with the trees salt balance, resulting in sub-lethal and potentially lethal effects.
- Acute impacts to mangroves can be observed within weeks of exposure, whereas chronic impacts may take months to years to detect.

Shoreline Habitats

A change in habitat may occur due to a change in water or sediment quality following an unplanned hydrocarbon release as follows:

- Hydrocarbons that contact sandy shores may be incorporated into fine sediments through mixing in the surface layers from wave energy, penetration down worm burrows and root pores.
- Hydrocarbon in the intertidal zone can adhere to sand particles however high tide may remove some or most of the hydrocarbon from the sediments. Accumulated hydrocarbons ≥ 100 g/m² could impact the survival and reproductive capacity of benthic epifaunal invertebrates living in intertidal habitat (French-McCay, 2009).
- Coastal habitats that occur on the coastline within the EMBA include saltmarshes and mangroves around the Dampier Archipelago.

Saltmarshes

A change in habitat may occur due to a change in water or sediment quality following an unplanned hydrocarbon release as follows:

- Areas of saltmarshes are known to occur within the Dampier Archipelago and WA Coastline, with both areas potentially receiving shoreline accumulation above 100 g/m²**.** Modelling predicts that there is 1% probability of these shorelines being contacted over the exposure threshold, with a maximum local volume predicted to accumulate of 3 m^3.
- Hydrocarbons can enter saltmarsh systems during the tidal cycles, if the estuary/inlet is open to the ocean. Similar to mangroves, this can lead to a patchy distribution of the oil and its effects, due to different areas within the inlets at different tidal heights.
- Hydrocarbons can adhere to the marshes, coating the stems from tidal height to sediment surface.

Key Ecological Features

Change in habitat may occur due to a change in water or sediment quality that could impact KEFs. The location of the KEFS within the EMBA are presented in **Section 4.7**. As marine diesel typically remains in the top 10 m of the water column and rapidly weathers, in-water hydrocarbons are only likely to intersect with seafloor and demersal values in shallower waters. The water depths and potential impacts to the six relevant KEFs are summarised as follows:

- Exmouth Plateau KEF (intersects the Operational Area and EMBA): Values and sensitivities are related to seafloor features. Receptors on the seafloor are not expected to be impacted by a surface release of hydrocarbons, given the water depths (~930 m). However, these seafloor features may promote enhanced upwelling; potential impacts to plankton and fishes are discussed above.
- Ancient Coastline KEF (intersects the Operational Area and EMBA): The KEF includes areas of hard substrate and higher diversity and species richness relative to surrounding areas of predominantly soft sediment. Given the minimum water depth in this KEF is 115 m, seafloor receptors are unlikely to be impacted by a surface hydrocarbon release. However, the submerged coastline may facilitate mixing of the water column enhancing productivity. Combined with greater diversity of sessile benthic organisms, this may increase abundance of pelagic species such as fishes and cetaceans, impacts to which are discussed above.
- Continental Slope Demersal Fish Communities KEF (intersects the Operational Area and EMBA): The KEF represents high levels of endemism of demersal fish species. Considering the minimum water depths of this KEF are 220–500 m and 750–1,000 m, impacts to demersal fishes are unlikely to occur. However, the values of the KEF may support higher order consumers, such as pelagic fish and shark species, impacts to which are discussed above.
- Canyons linking the Cuvier Abyssal Plain and the Cape Range Peninsula KEF (intersects the EMBA): Aggregations of whale sharks, manta rays, humpback whales, sea snakes, sharks, predatory fishes and seabirds are known to occur in the KEF due to its enhanced productivity, impacts to which are discussed above.
- Commonwealth Waters Adjacent to Ningaloo KEF (intersects the EMBA): The spatial boundary of this KEF, as defined in the National Conservation Values Atlas, is the waters contained in the existing Ningaloo AMP and is described below.
- Glomar Shoal KEF (intersects the EMBA on the Rowley shelf at depths of 33 m to 77 m): The values of the KEF are high productivity and aggregations of marine life, impacts to which are discussed above.
- Western demersal slope and associated fish communities KEF (intersects the EMBA): The KEF supports high biodiversity of demersal fish communities, impacts to which are discussed above.

- Wallaby Saddle (intersects the EMBA): The KEF is defined for its high productivity and aggregations of marine life. These values apply to both the benthic and pelagic habitats within the feature, impacts to which are discussed above.

AMPs

Quantitative stochastic spill modelling predicts contact above the relevant exposure threshold at the AMPs:

- Montebello Marine Park
- Dampier Marine Park
- Gascoyne Marine Park
- Ningaloo Marine Park
- Argo-Rowley Terrace Marine Park
- Carnarvon Canyon Marine Park
- Abrolhos Marine Park
- Eighty Mile Beach Marine Park
- Shark Bay Marine Park

The hydrocarbon spill is unlikely to result in significant impacts to AMPs based on the nature of the spilled hydrocarbons. Natural values for the AMPs include:

- Marine turtle BIAs for Dampier, Gascoyne, Ningaloo, Montebello and Eighty Mile Beach Marine Parks
- Humpback whale migration BIAs for Montebello, Dampier and Gascoyne Marine Parks, Ningaloo Marine Park
- Pygmy blue whale possible foraging area and migration BIA for Gascoyne, Ningaloo Marine Parks and Montebello Marine Park
- Dugong breeding, nursing, calving habitat BIA for Exmouth Gulf and Ningaloo Marine Park
- Diverse fish communities for the Dampier, Gascoyne, Ningaloo or Montebello Marine Parks, as well as Argo-Rowley Terrace Marine Park, Carnarvon Canyon Marine Park, Abrolhos Islands Marine Park, Eighty Mile Beach Marine Park
- Diverse fish communities specifically within the Continental Slope Demersal Fish Communities KEF for Gascoyne and Ningaloo Marine Parks
- Whale shark foraging habitat BIAs for Montebello and Ningaloo Marine Parks
- Seabird breeding habitat BIAs for Montebello, Dampier, Gascoyne and Ningaloo Marine Parks, as well as Argo-Rowley Terrace Marine Park, Carnarvon Canyon Marine Park, Abrolhos Islands Marine Park, Eighty Mile Beach Marine Park
- Seabird foraging habitat BIAs for Dampier, Gascoyne, Ningaloo, Montebello, Argo-Rowley Terrace, Carnarvon Canyon, Abrolhos Islands and Eighty Mile Beach Marine Parks.

State Waters Protected Places

Quantitative spill modelling predicts contact above the relevant exposure threshold at the following protected places (RPS, 2019, 2021):

- Barrow Island
- Muiron Islands MMA-WHA
- Montebello State Marine Park
- Thevenard Island Nature Reserve
- Ningaloo State Marine Park

A hydrocarbon spill is unlikely to result in significant impacts to State protected places based on the nature of the spilled hydrocarbons.

The conservation values of these areas have been previously described but include foraging and migratory pathways for some species of seabirds, whale shark, turtles and whales.

Commonwealth and State-managed Fisheries

Change in marine fauna behaviour or injury or mortality to marine fauna, in particular to commercially targeted species, or their prey species (e.g. plankton) can impact fisheries as follows:

- Fish exposure to hydrocarbon can result in ‘tainting’ of their tissues. Even very low levels of hydrocarbons can impart a taint or ‘off’ flavour or smell in seafood.
- Tainting is reversible through the process of depuration which removes hydrocarbons from tissues by metabolic processes, although it depends on the magnitude of the contamination.
- Fishes have a high capacity to metabolise these hydrocarbons while crustaceans (such as prawns) have a reduced ability (Yender et al., 2002).

- Actual or potential contamination of seafood can affect commercial and recreational fishing and can impact seafood markets long after any actual risk to seafood from a spill has subsided (Yender et al., 2002).
- The only Commonwealth-managed fishery expected to be active within the vicinity of the Operational Area is the NWSTF (**Section 4.9.2**). However, given the fishing method (i.e. trawl) and operations in deep water areas (>200 m) of this fishery, no significant impact from a marine diesel spill is predicted.
- Presence of hydrocarbons in areas used by State-managed fisheries (**Section 4.9.2**) may occur, however given the type of hydrocarbon and duration of exposure, no significant impact from a marine diesel spill is expected to occur.
- A major hydrocarbon spill could result in the establishment of an exclusion zone around the spill affected area. Within this exclusion zone there would be a temporary prohibition on fishing activities for a designated period of time, and subsequent potential for economic impacts to affected commercial fishing operators.

Tourism and Recreation and Cultural Values

Change in marine fauna behaviour, injury or mortality to marine fauna, change in aesthetic value and change to the functions, interests or activities of other users would impact tourism and recreation following an unplanned hydrocarbon release as follows:

- Charter fishing, diving, snorkelling, marine fauna (whale, marine turtle and dolphin) watching and cruises are the main commercial tourism activities in and adjacent to the NWMR. With the exception of offshore charter fishing, most marine tourism activities occur in State waters (DEWHA, 2008).
- Any impacts to receptors that provide nature-based tourism features (e.g. whales) may cause a subsequent negative impact to recreation and tourism activities. There is also potential for impacts to the 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.
- It is acknowledged that the Dampier Archipelago (and other areas of the WA coastline) contain Indigenous sites of cultural importance (as described in **Section 4.9.4**). There is a low probability of surface contact at the socio-cultural threshold with WA coastlines. It is determined that a spill is unlikely to result in significant impacts based on the nature of the spilled hydrocarbons.

Shipping

A change to the functions, interests or activities of other users may impact shipping following an unplanned hydrocarbon release as follows:

- In the event of a large spill, an exclusion zone may be established around the spill affected area. This could result in exclusion of other users such as shipping vessels or vessels used by the mining and petroleum industries. Any exclusion zone established would be limited to the immediate vicinity of the release point, and due to the rapid weathering of marine diesel would only be in place for days after release, therefore physical displacement to vessels is unlikely to be a significant impact.
- The environmental performance outcome for shipping is to not interfere with other marine users, including shipping, to a greater extent than is necessary for the exercise of right conferred by the titles granted.
- Given hydrocarbon characteristics, expected rapid weathering to below impact thresholds, short duration of displacement, and the offshore location of the PAA, unplanned releases of MDO are not expected to interfere with shipping to a greater extent than necessary. Based on the assessment, the magnitude of a potential impact to shipping associated with an unplanned release of hydrocarbons is slight. Receptor sensitivity of shipping is medium (medium value user), and therefore the consequence of a release of hydrocarbons on shipping is Slight (E).

Industry

A change in water quality and change to the functions, interests or activities of other users may impact industry following an unplanned hydrocarbon release, summarised from Section 7.2.6.2 of the Scarborough OPP (SA0006AF0000002, Rev 5) as follows:

- In the event of a major hydrocarbon spill, an exclusion zone may be established around the spill affected area. This could result in exclusion of other users such as vessels used by the mining and petroleum industries.
- The closest oil and gas development to the Scarborough field is Chevron Australia's *Jansz Io* fields, about 100 km to the east. However, all infrastructure is subsea and is not expected to be impacted by a marine diesel spill.

Defence

A change to the functions, interests or activities of other users may impact Defence following an unplanned hydrocarbon release as follows:

- In the event of a major hydrocarbon spill, an exclusion zone may be established around the spill affected area. This could impact Defence by restricting areas where training or exercises can be conducted, for a designated period of time.

- Any exclusion zone established would be limited to the immediate vicinity of the release point, and due to the rapid weathering of marine diesel would only be in place for days after release, therefore physical displacement to vessels is unlikely to be a significant impact.

Summary of Assessment Outcomes

Receptor	Impact	Receptor Sensitivity	Consequence	Likelihood	Risk Rating
Water quality	Change in water quality	Low value (open water)	Negligible (F)	Highly Unlikely	Low
Plankton	Injury/mortality to fauna	Low value (open water)	Negligible (F)	Highly Unlikely	Low
Fish, sharks and rays	Change in fauna behaviour	High species value	Minor (D)	Highly Unlikely	Moderate
	Injury/mortality to fauna		Minor (D)	Highly Unlikely	Moderate
Marine mammals	Change in fauna behaviour	High species value (i.e. pygmy blue whale)	Minor (D)	Highly Unlikely	Moderate
	Injury/mortality to fauna		Minor (D)	Highly Unlikely	Moderate
Marine reptiles	Change in fauna behaviour	High species value (i.e. flatback, green and hawksbill turtles)	Slight (E)	Highly Unlikely	Low
	Injury/mortality to fauna		Minor (D)	Highly Unlikely	Moderate
Seabirds and migratory shorebirds	Change in fauna behaviour	High species value	Slight (E)	Highly Unlikely	Low
	Injury/mortality to fauna		Minor (D)	Highly Unlikely	Moderate
Coral	Change in habitat	High value habitat	Major (B)	Highly Unlikely	Moderate
Seagrass	Change in habitat	High value habitat	Slight (E)	Highly Unlikely	Low
Macroalgae	Change in habitat	Low value habitat (homogenous)	Negligible (F)	Highly Unlikely	Low
Mangroves	Change in habitat	High value habitat	Slight (E)	Highly Unlikely	Low
Shoreline habitats	Change in habitat	Low value habitat	Negligible (F)	Highly Unlikely	Low
Saltmarshes	Change in habitat	High value habitat	Slight (E)	Highly Unlikely	Low
KEFs	Change in habitat	High value	Minor (D)	Highly Unlikely	Moderate
AMPs	Change in habitat	High value	Minor (D)	Highly Unlikely	Moderate
State Waters Protected Places	Change in habitat	Medium value	Slight (E)	Highly Unlikely	Low
Commonwealth and State-managed fisheries	Changes to the functions, interests or activities of other users	High value marine user	Slight (E)	Highly Unlikely	Low

Tourism and recreation / cultural heritage	Changes to the functions, interests or activities of other users	Medium value users	Slight (E)	Highly Unlikely	Low
Shipping	Changes to the functions, interests or activities of other users	Medium value users	Slight (E)	Highly Unlikely	Low
Industry	Changes to the functions, interests or activities of other users	Medium value	Slight (E)	Highly Unlikely	Low
Defence	Changes to the functions, interests or activities of other users	Medium value	Slight (E)	Highly Unlikely	Low
Overall Risk Consequence: The overall risk consequence/risk rating for an unplanned hydrocarbon release in the event of a vessel collision is Moderate based on a Major consequence to the high value receptor (coral). The risk consequence/risk ratings for individual receptors are consistent with the levels rated in the Scarborough OPP.					

Table 6-23: Environment that May Be Affected – Key receptor locations and sensitivities with the summary hydrocarbon spill contact for a 2,000 m³ instantaneous marine diesel spill at three release locations

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 (diesel) (%) note: the probability is based on stochastic modelling of 100 - 200 hypothetical worst-case spills under a variety of weather and metocean conditions					
		Physical		Biological																						Socio-economic and Cultural					Socio-cultural EMBA		Ecological EMBA			
		Water Quality	*Sediment Quality*	*Marine Primary Producers*			*Other Communities / Habitats*								*Protected Species*									*Other Species*		*Fisheries – commercial*	*Fisheries – traditional*	*Tourism and Recreation*	*Protected Areas / Heritage – European and Indigenous / Shipwrecks*	*Offshore Oil and Gas Infrastructure (topside and subsea)*						
		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*	*Sea snakes*	*Whale sharks*	*Sharks and rays*	*Sea birds and/or migratory shorebirds*	*Pelagic fish populations*	*Resident /Demersal Fish*						*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	Dampier AMP	✓		✓	✓	✓	✓	✓	✓	✓					✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓		✓	✓		3		2	54	24	
	Montebello AMP	✓	✓	✓			✓	✓							✓	✓			✓	✓	✓	✓	✓	✓	✓	✓		✓	✓		100		100	78	49	
	Gascoyne AMP	✓	✓					✓		✓					✓	✓			✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	1			11	3	
	Shark Bay WHA	✓	✓			✓		✓							✓	✓	✓		✓	✓		✓	✓	✓	✓	✓		✓	✓					1		
	Argo-Rowley Terrace AMP	✓						✓							✓	✓			✓			✓	✓	✓		✓			✓					1		
	Carnarvon Canyon AMP	✓	✓					✓		✓														✓	✓	✓			✓					1		
	Abrolhos Islands AMP	✓	✓	✓			✓	✓		✓						✓		✓	✓	✓		✓	✓	✓	✓			✓	✓					1		
	Eighty Mile Beach AMP	✓	✓	✓	✓	✓	✓				✓	✓	✓	✓	✓	✓	✓		✓	✓		✓	✓	✓	✓	✓		✓	✓					1		
Submerged shoals	Glomar Shoals	✓	✓	✓				✓							✓					✓	✓	✓		✓	✓	✓		✓								
	Rankin Bank	✓	✓	✓			✓	✓		✓						✓				✓		✓		✓	✓	✓		✓						1	1	
Islands	Montebello Islands (including State Marine Park)	✓	✓	✓	✓	✓	✓	✓				✓		✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓				13	1	

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 (diesel) (%)					
		Physical		Biological																						Socio-economic and Cultural					note: the probability is based on stochastic modelling of 100 - 200 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*		*Fisheries – commercial*	*Fisheries – traditional*	*Tourism and Recreation*	*Protected Areas / Heritage – European and Indigenous / Shipwrecks*	*Offshore Oil and Gas Infrastructure (topside and subsea)*	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*	*Sea snakes*	*Whale sharks*	*Sharks and rays*	*Sea birds and/or migratory shorebirds*	*Pelagic fish populations*	*Resident /Demersal Fish*						*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)*
	Lowendal Islands	✓	✓	✓	✓	✓	✓	✓				✓		✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓				1		
	Barrow Island	✓	✓	✓	✓	✓	✓	✓				✓		✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓				5	1	
	Muiron Islands (MMA-WHA)	✓	✓	✓	✓	✓	✓	✓		✓		✓		✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓			✓	✓					13		
	Pilbara Islands – Southern Island Group	✓	✓		✓		✓		✓			✓		✓		✓	✓		✓	✓		✓	✓	✓	✓	✓		✓	✓					7		
	Pilbara Islands - Middle Pilbara - Islands & Shoreline	✓	✓		✓		✓		✓			✓		✓		✓	✓		✓	✓		✓	✓	✓	✓	✓		✓	✓					5		
	Bernier & Dorre Islands	✓	✓	✓	✓	✓	✓					✓		✓			✓		✓			✓	✓	✓	✓									1		
Mainland (nearshore waters)	Dampier Archipelago	✓		✓	✓	✓		✓		✓	✓	✓	✓		✓	✓	✓		✓	✓	✓	✓	✓		✓			✓	✓		4	1	2	51	15	
	Ningaloo Coast North/North WHA and South/South WHA	✓	✓	✓	✓	✓	✓	✓		✓		✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓		✓	✓					12		
	Ningaloo RUZ	✓	✓	✓	✓	✓	✓	✓		✓		✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓		✓	✓					12		
	Shark Bay Open Ocean Coast	✓	✓	✓	✓	✓	✓	✓		✓						✓	✓		✓	✓		✓	✓	✓	✓	✓		✓	✓					1		

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 (diesel) (%)					
		Physical		Biological																						Socio-economic and Cultural					note: the probability is based on stochastic modelling of 100 - 200 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		Fisheries – commercial	Fisheries – traditional	Tourism and Recreation	Protected Areas / Heritage – European and Indigenous / Shipwrecks	Offshore Oil and Gas Infrastructure (topside and subsea)	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*	*Sea snakes*	*Whale sharks*	*Sharks and rays*	*Sea birds and/or migratory shorebirds*	*Pelagic fish populations*	*Resident /Demersal Fish*						*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)*
	WA coastline	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓		✓	✓		4	1	3	51	15	

Demonstration of ALARP				
Control Considered	***Control Feasibility (F) and Cost/Sacrifice (CS)***	***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 look-outs (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 9.1**
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 SOLAS • 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 resulting in a collision.	Controls based on legislative requirements – must be adopted.	Yes **C 9.2**
In the event of a spill, emergency response activities implemented in accordance with the OPEP (per **Table 7-7**).	F: Yes CS: Costs associated with implementing response strategies, vary dependant on nature and scale of spill event. Standard practice.	Potentially reduces consequence by implementing response to reduce impacts to the marine environment	Control based on regulatory requirement – must be adopted.	Yes **C 9.3**

Demonstration of ALARP				
Control Considered	***Control Feasibility (F) and Cost/Sacrifice (CS)***	***Benefit in Impact/Risk Reduction***	***Proportionality***	***Control Adopted***
Arrangements supporting the activities in the OPEP (per **Table 7-7**) will be tested to ensure the OPEP can be implemented as planned.	F: Yes. CS: Moderate costs associated with exercises. Standard practice.	No change to impact or risk however ensures OPEP can be implemented in the event of a hydrocarbon spill thereby potentially reducing the consequence.	Control based on regulatory requirement – must be adopted.	Yes **C 9.4**
Establishment of temporary exclusion zones around vessels which are 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 1.2**
Good Practice				
Have a support vessel on standby during all activities to communicate with third-party vessels and help maintain a safety exclusion zone.	F: Yes. CS: Additional costs.	Given the legislative controls in place and the duration of the activities, as well as the mobility of most project vessels (excluding the PV); using a support vessel will provide only a small reduction in the likelihood of a collision with a third party vessel. The PV will have continual other vessels working alongside / in the vicinity which can act in a standby vessel capacity if needed.	Grossly disproportionate.	No
Develop SIMOPS management plan when working in vicinity of other Woodside operations / activities.	F: Yes. CS: Minimal cost. Standard practice.	SIMOPS management plans between Woodside operated vessels in the Operational Area will reduce the likelihood of a collision occurring.	Benefits outweigh cost/sacrifice.	Yes **C 9.5**
Notify AHS of activities and movements no less than 4 working weeks prior to scheduled activity commencement date.	F: Yes. CS: Minimal cost. Standard practice.	Notification of AHS will enable issuing of notices to mariners as required thereby reducing the likelihood of a collision with a third party vessel.	Benefits outweigh cost/sacrifice. Control is also Standard Practice.	Yes **C 1.3**
Notify AMSA JRCC of activities and movements of the activity 24-48 hours	F: Yes. CS: Minimal cost. Standard practice.	Communication of the Petroleum Activities Program to other marine users ensures	Benefits outweigh cost/sacrifice.	Yes **C 1.5**

Demonstration of ALARP				
Control Considered	***Control Feasibility (F) and Cost/Sacrifice (CS)***	***Benefit in Impact/Risk Reduction***	***Proportionality***	***Control Adopted***
before operations commence.		they are informed and aware, thereby reducing the likelihood of a collision with a third party vessel occurring.	Control is also Standard Practice.	
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 Solutions				
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 2.4.2**), Woodside considers the adopted controls appropriate to manage the risks and consequences 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 risks and consequences without grossly disproportionate sacrifice, the risks and consequences are considered ALARP.				

Demonstration of Acceptability
Acceptability Criteria and Assessment
The Petroleum Activities Program meets the acceptability criteria (**Section 2.3.5**): • Overall risk consequence/risk ratings for individual receptors are consistent with the levels rated in the Scarborough OPP. • EPOs and controls in the Scarborough OPP that are relevant to an unplanned hydrocarbon release from a vessel collision have been adopted. • There are no changes to internal/external context specific to this risk from the Scarborough OPP, including issues raised during stakeholder consultation. Following consultations with DNP on the potential risks to AMPs, the DNP noted it has no objections and claims at this time.
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 is unlikely to result in a risk consequence greater than Major (corals). 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 AHS identified during impact assessment and stakeholder consultation. Further opportunities to reduce the impacts have been investigated above. The potential risks and consequences are considered acceptable if the adopted controls are implemented. Therefore, Woodside considers the adopted controls

appropriate to manage the risks and consequences of a loss of vessel structural integrity to a level that is acceptable if ALARP.

Environmental Performance Outcomes, Standards and Measurement Criteria			
EPO	***Adopted Control(s)***	***EPS***	***MC***
EPO 19 No release of hydrocarbons to the marine environment due to a vessel collision associated with the Petroleum Activities Program.	**C 9.1** Marine Order 30 – Prevention of collisions – 2016, including: • adherence to steering and sailing rules including maintaining look-outs (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 9.1** Vessels compliant with Marine Order 30 (Prevention of Collisions) 2016 (which requires vessels to be visible at all times) to prevent unplanned interaction with marine users.	**MC 9.1.1** Marine assurance inspection records demonstrate compliance with standard maritime safety procedures (Marine Orders 21 and 30).
	C 9.2 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 SOLAS • 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.	**PS 9.2** Vessels compliant with Marine Order Marine Orders 21 (Safety and emergency arrangements) 2016 to prevent unplanned interaction with marine users.	
	C 9.3	**PS 9.3**	**MC 9.3.1**

Environmental Performance Outcomes, Standards and Measurement Criteria			
EPO	***Adopted Control(s)***	***EPS***	***MC***
	In the event of a spill emergency response activities implemented in accordance with the OPEP (**Table 7-7**).	In the event of a spill the OPEP requirements are implemented.	Completed incident Documentation shows requirements of OPEP were implemented in the event of a spill.
	C 9.4 Arrangements supporting the activities in the OPEP (**Table 7-7**) will be tested to ensure the OPEP can be implemented as planned.	**PS 9.4.1** Exercises/tests will be conducted in alignment with the frequency identified in **Table 7-9**.	**MC 9.4.1** Testing of arrangement records confirm that emergency response capability has been maintained.
		PS 9.4.2 Woodside's procedure demonstrates a minimum level of trained personnel, for core roles in the OPEP are maintained.	**MC 9.4.2** Emergency Management dashboard confirms that minimum level of personnel trained for core OPEP roles are available.
	C 1.2 **See Section 6.6.1**	**PS 1.2** **See Section 6.6.1**	**MC 1.2.1** **See Section 6.6.1**
			MC 1.2.2 **See Section 6.6.1**
	C 9.5 Develop SIMOPS management plan when working in vicinity of other Woodside operations / activities.	**PS 9.5** SIMOPS management plan is in place when working in vicinity of other Woodside operations / activities.	**MC 9.5.1** Records indicate a SIMOPS management plan has been created.
	C 1.3 See **Section 6.6.1**	**PS 1.3** See **Section 6.6.1**	**MC 1.3.1** See **Section 6.6.1**
	C 1.5 See **Section 6.6.1**	**PS 1.5** See **Section 6.6.1**	**MC 1.5.1** See **Section 6.6.1**
Detailed preparedness and response performance outcomes, standards and measurement criteria for the Petroleum Activities Program are present in **Appendix D.**			

6.7.3 Unplanned Hydrocarbon Release – Bunkering

Scarborough OPP – Relevant Impact Assessment Section		
Section 7.2.6 – Unplanned Hydrocarbon Release		
Context		
Relevant Activities Vessel Operations – **Section 3.7**	**Existing Environment** Physical Environment – **Section 4.4** Habitats and Biological Communities – **Section 4.5** Protected Species – **Section 4.6**	**Stakeholder consultation** Consultation – **Section 5** No stakeholder concerns have been raised with respect to hydrocarbon spills or potentially impacted receptors.

Impact/Risk Evaluation Summary

Source of Impact/Risk	*Environmental Value Potentially Impacted*							*Evaluation*						
	Soil and Groundwater	**Marine Sediment**	**Water Quality**	**Air Quality (inc. odour)**	**Ecosystems / Habitat**	**Species**	**Socio-economic**	**Decision Type**	**Impact/Consequence**	**Likelihood**	**Current Risk Rating**	**ALARP Tools**	**Acceptability**	**Outcome**
Loss of hydrocarbons to marine environment from bunkering/ refuelling			✓			✓		A	F	2	L	LCS GP PJ	Broadly Acceptable	EPO 20

Description of Source of Impact/Risk

Bunkering of marine diesel may occur within the Operational Area. Three credible scenarios for the loss of containment of marine diesel during bunkering operations have been 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 and complete loss of hose volume).
- Partial or total failure of a bulk transfer hose or fittings during bunkering, combined with a delay to shutoff fuel pumps, for a period of up to 15 minutes at a maximum transfer rate of 220 m^3/hr for the PV, resulting in approximately 55 m^3 (55,000L) marine diesel loss as 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 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 <100 L.

Likelihood

Woodside spill records indicates that while there have been smaller releases (<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.

International Tanker Owners Pollution Federation Limited (IOTPF) (2020) data reports that for tanker operations during 1970-2017, 7% of small (<7 tonnes) spills occurred during bunkering and 2% of medium (7-700 tonnes) spills. Whilst this data is from the oil tanker industry it has been used as an indicator of 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

Exposure to threshold concentrations from a 55,000 L surface spill from bunkering activities would be well within the EMBA for the vessel collision scenario detailed in **Section 6.7.2.** 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 55,000 L marine diesel release was not undertaken 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 spill volumes likely to be contained on the helideck, this was not modelled.

Hydrocarbon Characteristics

Refer to **Section 6.7.2** for a description of the characteristics of marine diesel, including detail on the predicted fate and weathering of a spill to the marine environment.

Detailed Impact Assessment

Assessment of Potential Impacts

An unplanned hydrocarbon release during bunkering has the potential to result in the following impacts:

- change in water quality
- change in fauna behaviour

A 55 m³ (55,000L) marine diesel surface release as a result of bunkering activities is expected to be confined to within several kilometres of the release site, and well within the EMBA identified for the vessel collision scenario detailed in **Section 6.7.2**.

In the unlikely event of an unplanned hydrocarbon release from bunkering, the limited volume may lead to minor impacts to megafauna, plankton and fish populations (surface and water column biota) that are within the spill affected area, minor impacts to commercial fisheries may also occur.

The potential biological and ecological impacts associated with much larger hydrocarbon spills (i.e. vessel collision) are presented in **Section 6.7.2** and include behavioural changes to fish, marine mammals and marine reptiles. The extent of the EMBA associated with a marine diesel spill from bunkering will be much reduced in terms of spatial and temporal scales, and hence, potential impacts from bunkering are considered negligible.

Summary of Assessment Outcomes

Receptor	Impact	Receptor Sensitivity	Consequence	Likelihood	Risk Rating
Water quality	Change in water quality	Low value (open water)	Negligible (F)	Unlikely	Low
Fish, sharks and rays	Change in fauna behaviour	High species value	Negligible (F)	Unlikely	Low
Marine mammals	Change in fauna behaviour	High species value (i.e. pygmy blue whale)	Negligible (F)	Unlikely	Low
Marine reptiles	Change in fauna behaviour	High species value (i.e. flatback, green and hawksbill turtles)	Negligible (F)	Unlikely	Low
	Injury/mortality to fauna		Negligible (F)	Unlikely	Low

Overall Impact Significance Level/ Risk Consequence: The overall impact significance level/risk rating for an unplanned hydrocarbon release resulting from a bunkering incident is Low based on a Negligible consequence to the most high value receptors (marine fauna). The risk consequence/risk ratings for individual receptors are consistent with the levels rated in the Scarborough OPP.

Demonstration of ALARP				
Control Considered	***Control Feasibility (F) and Cost/Sacrifice (CS)***	***Benefit in Impact/Risk Reduction***	***Proportionality***	***Control Adopted***
Legislation, Codes and Standards				
Marine Order 91 (marine pollution prevention – oil) 2014, requires Shipboard Oil Pollution Emergency Plan (SOPEP) /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 10.1**
Good Practice				
Bunkering equipment controls: • All hoses that have a potential environmental risk following damage or failure shall be linked to the vessel's preventative maintenance system. • All bulk transfer hoses shall have current certification and be in good condition, and inspected as required. • 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.	F: Yes. CS: Minimal cost. Standard practice.	By ensuring the appropriate equipment is in place, tested and maintained appropriately, the likelihood of a spill occurring is reduced. Although no significant reduction in consequence could result, the overall risk is reduced.	Benefits outweigh cost/sacrifice.	Yes **C 10.2**
Contractor procedures include requirements to be implemented during bunkering/refuelling operations, including: • Procedures and controls for bringing bunkering vessel alongside PV to prevent collision. • Implement a completed PTW and/or JSA for the hydrocarbon bunkering operation. • Visually monitor gauges, hoses, fittings and the sea surface during the operation. • Check hoses prior to commencement.	F: Yes. CS: Minimal cost. Standard practice.	By ensuring the appropriate equipment is in place, tested and maintained appropriately, the likelihood of a spill occurring is reduced. Although no significant reduction in consequence could result, the overall risk is reduced.	Benefits outweigh cost/sacrifice.	Yes **C 10.3**

Demonstration of ALARP				
Control Considered	***Control Feasibility (F) and Cost/Sacrifice (CS)***	***Benefit in Impact/Risk Reduction***	***Proportionality***	***Control Adopted***
• 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.				
Mitigation: oil spill response	Refer to **Appendix D**.			
Professional Judgement – Eliminate				
Preferentially avoid refuelling PV in the Montebello Marine Park	F: Yes, however cannot rule out refuelling in the marine park altogether due to Trunkline length in the marine park, fuel capacity and unknowns around fuel consumption (i.e. due to sea state and lay conditions at the time) CS: Schedule implications on timing refuelling to ensure enough fuel stored on board to get through activities in the marine park.	If able to avoid refuelling in the Montebello Marine Park, removes spill risk during bunkering activity which can reduce consequence potential to more sensitive marine receptors, compared to other areas of the PAP	Benefits outweigh cost/sacrifice.	Yes **C 10.4**
Bring all vessels to port to refuel	F: No. PV would be required to laydown the Trunkline to transit which significantly compromises Trunkline integrity and adds to installation time in the field. It is not operationally practical to transit vessels back to port for refuelling based on the frequency of the refuelling requirements and potential maximum distance from the nearest port. CS: Significant due to schedule delay, Trunkline integrity and vessel transit costs /	Eliminates the bunkering risk in the Operational Area, However, moves risk to another location. Therefore, no overall benefit.	Disproportionate. The cost/ sacrifice outweighs the benefit gained.	No

Demonstration of ALARP				
Control Considered	***Control Feasibility (F) and Cost/Sacrifice (CS)***	***Benefit in Impact/Risk Reduction***	***Proportionality***	***Control Adopted***
	risks, increased emissions and day rates.			
Professional Judgement – Substitute				
No additional controls identified.				
Professional Judgement – Engineered Solutions				
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 2.3.3**), Woodside considers the adopted controls appropriate to manage the risks and consequences of an unplanned loss of hydrocarbon as a result of a bunkering incident. 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 Criteria and Assessment
The Petroleum Activities Program meets the acceptability criteria (**Section 2.3.5**): • Overall risk consequence/risk ratings for individual receptors are consistent with the levels rated in the Scarborough OPP. • EPOs and controls in the Scarborough OPP that are relevant to an unplanned hydrocarbon release from bunkering have been adopted. • There are no changes to internal/external context specific to this risk from the Scarborough OPP, including issues raised during stakeholder consultation.
Acceptability Statement: The impact assessment has determined that accidental discharge of hydrocarbons from bunkering represents a low current risk rating and is unlikely to result in a risk consequence greater than Negligible. BIAs for 20 EPBC Act listed Threatened or Migratory species overlap the Operational Area or EMBA. 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 identified during impact assessment. Further opportunities to reduce the impacts have been investigated above. The potential risks and consequences are considered acceptable if the adopted controls are implemented. Therefore, Woodside considers the adopted controls appropriate to manage the risks of a loss of hydrocarbons during bunkering / refuelling to a level that is broadly acceptable.

Environmental Performance Outcomes, Standards and Measurement Criteria			
EPO	***Adopted Control(s)***	***EPS***	***MC***
EPO 20 Undertake the Petroleum Activities Program in a manner that will prevent an unplanned release of non-process/reservoir hydrocarbons to the marine environment resulting in a	**C 10.1** Marine Order 91 (marine pollution prevention – oil) 2014, requires SOPEP / SMPEP (as appropriate to vessel class).	**PS 10.1** Appropriate initial responses prearranged and exercised for response to a hydrocarbon spill, as appropriate to vessel class in compliance with Marine Order 91	**MC 10.1.1** Marine Assurance inspection records demonstrate compliance with Marine Order 91.

Environmental Performance Outcomes, Standards and Measurement Criteria			
EPO	***Adopted Control(s)***	***EPS***	***MC***
substantial change in water quality which may adversely impact on biodiversity, ecological integrity, social amenity or human health.		(marine pollution prevention – oil) 2014, requires SOPEP / SMPEP (as appropriate to vessel class).	
	C 10.2 Bunkering equipment controls: • All hoses that have a potential environmental risk following damage or failure shall be linked to the vessel's preventative maintenance system. • All bulk transfer hoses shall have current certification and be in good condition and inspected as required. • 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 10.2.1** Bunkering equipment will be put on the vessels preventative maintenance system to ensure damaged equipment is replaced prior to failure**.**	**MC 10.2.1** Records confirm the vessels bunkering equipment is subject to systematic integrity checks.
		PS 10.2.2 All diesel transfer hoses to have dry break couplings and pressure rating suitable for intended use.	**MC 10.2.2** Records confirm presence of dry break of couplings and flotation on fuel hoses.
		PS 10.2.3 Adequate resources are available to allow implementation of SOPEP.	**MC 10.2.3** Records confirm presence of spill kits or other resources as required by SOPEP.
	C 10.3 Contractor procedures include requirements to be implemented during bunkering/refuelling operations, including: • Procedures and controls for bringing bunkering vessel alongside to prevent collision. • Implement a completed PTW and/or JSA for the hydrocarbon bunkering 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	**PS 10.3** Compliance with Contractor procedures for management of bunkering/helicopter operations.	**MC 10.3.1** Records demonstrate bunkering/refuelling undertaken in accordance with Contractor bunkering procedures.

Environmental Performance Outcomes, Standards and Measurement Criteria			
EPO	***Adopted Control(s)***	***EPS***	***MC***
	the ability to determine if a spill has occurred. • Do not transfer hydrocarbons in marginal weather conditions.		
	C 10.4 Preferentially avoid refuelling PV in the Montebello Marine Park.	**PS 10.4** Refuelling the PV to preferentially avoid the Montebello Marine Park	**MC 10.4.1** Records demonstrate bunkering/refuelling planning for PV has assessed and prioritised avoidance of Montebello Marine Park where possible
Detailed oil spill preparedness and response performance outcomes, standards and measurement criteria for the Petroleum Activities Program are presented in **Appendix D.**			

6.7.4 Unplanned Discharge – Deck and Subsea Spills

Scarborough OPP – Relevant Impact Assessment Section		
Section 7.2.1 – Unplanned Discharge: Chemicals		
Context		
Relevant Activities Vessel Operations – **Section 3.7** ROV Operations – **Section 3.8.3**	**Existing Environment** Marine Regional Characteristics – **Section 4.2**	**Stakeholder consultation** Consultation – **Section 5** No stakeholder concerns have been raised with respect to unplanned chemical discharges or potentially impacted receptors.

Impact/Risk Evaluation Summary

Source of Impact/Risk	*Environmental Value Potentially Impacted*							*Evaluation*						
	Soil and Groundwater	Marine Sediment	Water Quality	Air Quality (inc. odour)	Ecosystems / Habitat	Species	Socio-economic	Decision Type	Impact/Consequence	Likelihood	Current Risk Rating	ALARP Tools	Acceptability	Outcome
Accidental discharge of hydrocarbons/ chemicals from project vessels deck activities and equipment, and from subsea ROV hydraulic leaks			✓			✓		A	E	1	L	LCS GP PJ	Broadly Acceptable	EPO 3

Description of Source of Impact/Risk

Vessel Operations

Hydrocarbons/chemicals are used during vessel and ROV activities for a variety of purposes within the Operational Area. Spills may include:

- Chemicals (maintenance and cleaning chemicals). Generally held onboard in low quantities (typically <50 L containers). Spills of these chemicals may result from human error or damage to a chemical container during handling. In the event that a spill is not contained on deck or within a bunded area, there would be a release to the marine environment of up to 50 L.
- Hydraulic fluids used in machinery (including cranes, winches, ROVs, TSHD drag head, pipelay stinger). Unplanned discharges are predominantly due to failure of hydraulic hoses or minor leaks from process components, or spills during periodic refuelling of hydraulic hoses. Volumes of hydraulic fluids contained in ROV hydraulic hoses to be used can be up to approximately 400 L, while hydraulic fluids contained in hoses of key equipment may be in the order of 2 m^3. Operational experience demonstrates that spills are most likely to originate from hydraulic hoses and have been less than 100 L, with a typical volume of <20 L (based on capacity of hydraulic hose). All equipment is subject to planned maintenance as preventative measures against unplanned spills.

Survey Equipment

Survey vessels will place equipment on the seabed which may contain relatively small volumes of hydraulic fluid, about 5-10 L, depending on the system. The hydraulic fluid enables various mechanical functions to be performed.

If a Boomer, Chirp or Sparker system is used, the receiver will consist of individual hydrophone elements located within neutrally buoyant, synthetic hydrocarbon filled tubing. The hydrophone cable has the potential to be punctured, resulting a leakage of fluid for a variety of reasons, including damage during deployment or retrieval.

Detailed Impact Assessment
Assessment of Potential Impacts
Water Quality Unplanned discharges of non-process chemicals and hydrocarbons may decrease the water quality in the immediate vicinity of the release. Only small volumes (<20 L) are anticipated, resulting in very short-term impacts to water quality, and limited to the immediate release location. The open water location and relatively small unplanned volumes of hydrocarbons/chemicals released will result in rapid dilution close to the source of discharge. Given the occasional nature of unplanned deck and subsea discharges, the small volumes, and the offshore location of the Operational Area, any changes to water quality are expected to have no lasting effects. ***Marine Fauna*** As a result of a change in water quality, further impacts to receptors may occur, which include injury or mortality to marine fauna resulting from exposure to toxins in the released chemicals. Physical coating of marine fauna and sub-lethal or lethal toxic effects from hydrocarbons/chemicals are considered unlikely given the low volumes of potential discharge, short exposure times and the rapid dilution and dispersion of discharges once entering the marine environment. Impacts to marine fauna are expected to be limited to temporary irritation of sensitive membranes to individuals and are considered negligible.

Summary of Assessment Outcomes					
Receptor	**Impact**	**Receptor Sensitivity**	**Consequence**	**Likelihood**	**Risk Rating**
Water quality	Change in water quality	Low value (open water)	Negligible (F)	Highly Unlikely	Low
Migratory Shorebirds and Seabirds	Injury/mortality to fauna	High value species	Slight (E)	Highly Unlikely	Low
Fish		High value species	Slight (E)	Highly Unlikely	Low
Marine Mammals		High value species	Slight (E)	Highly Unlikely	Low
Marine Reptiles		High value species	Slight (E)	Highly Unlikely	Low
Overall Risk Consequence: The overall risk consequence/risk rating for an unplanned deck and subsea spills is Low based on no lasting effect to the high value receptors (marine fauna). The risk consequence/risk ratings for water quality is consistent with the levels rated in the Scarborough OPP. Potential impacts to marine fauna have been additionally assessed in this EP. There is no change in risk rating (low); however, the risk consequence is slightly higher due to the higher receptor sensitivity level.					

Demonstration of ALARP				
Control Considered	***Control Feasibility (F) and Cost/Sacrifice (CS)***	***Benefit in Impact/Risk Reduction***	***Proportionality***	***Control Adopted***
Legislation, Codes and Standards				
Marine Order 91 (marine pollution prevention – oil) 2014, requires SOPEP / 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	Controls based on legislative requirements – must be adopted.	Yes **C 10.1**

Demonstration of ALARP				
Control Considered	***Control Feasibility (F) and Cost/Sacrifice (CS)***	***Benefit in Impact/Risk Reduction***	***Proportionality***	***Control Adopted***
		result, the overall risk is reduced.		
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.	Implementation of procedures for chemical storage and handling on the vessels will reduce the consequence of impacts resulting from unplanned discharges to the marine environment by ensuring chemicals have been assessed for environmental acceptability.	Controls based on legislative requirements – must be adopted.	Yes **C 11.1**
Good Practice				
Spill kits positioned in high risk locations around the vessel (near potential spill points such as transfer stations).	F: Yes. CS: Minimal cost. Standard practice.	Spill kits would reduce the likelihood of a deck spill from entering the marine environment. The consequence is unchanged.	Benefits outweigh cost/sacrifice.	Yes **C 11.2**
Implementation of waste management procedures which provide for safe handling and transportation, segregation and storage and appropriate classification of all waste generated.	F: Yes. CS: Minimal cost. Standard practice.	Controls outlined in the management plan will reduce the likelihood of an unplanned release. The consequence is unchanged.	Benefits outweigh cost sacrifice.	Yes **C 11.3**
Chemicals will be selected with the lowest practicable environmental impacts and risks subject to technical constraints.	F: Yes. CS: Minimal cost. Standard practice.	Environmental assessment of chemicals in discharges 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 7.4**
Mitigation: oil spill response	Refer to **Appendix D**.			
Professional Judgement – Eliminate				
No additional controls identified.				

Demonstration of ALARP				
Control Considered	***Control Feasibility (F) and Cost/Sacrifice (CS)***	***Benefit in Impact/Risk Reduction***	***Proportionality***	***Control Adopted***
Professional Judgement – Substitute				
No additional controls identified.				
Professional Judgement – Engineered Solutions				
Below-deck storage of hydrocarbons and chemicals where practicable.	F: Yes. It is feasible to store some level of inventory for hydrocarbons and chemicals below-deck when not in use. CS: Time in double-handling of chemicals / hydrocarbons in moving below-deck and then back to upper deck for use. H&S risks associated with moving and handling chemicals / hydrocarbons	Storage of chemicals and hydrocarbons below deck where practicable can reduce the likelihood of spills which may escalate overboard.	Benefits outweigh cost/sacrifice.	Yes **C 11.4**
A reduction in the volumes of chemicals and hydrocarbons stored onboard vessels.	F: Yes. 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

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 2.3.3**)), Woodside considers the adopted controls appropriate to manage the risks and consequences of an unplanned deck and subsea spills. 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 Criteria and Assessment

The Petroleum Activities Program meets the acceptability criteria (**Section 2.3.5**)**:**

- Overall risk consequence/risk ratings for individual receptors are consistent with the levels rated in the Scarborough OPP.
- EPOs and controls in the Scarborough OPP that are relevant to an unplanned deck or subsea spill have been adopted.
- There are no changes to internal/external context specific to this risk from the Scarborough OPP, including issues raised during stakeholder consultation. [HOLD – statement TBC following consultation]

Acceptability Statement:

The impact assessment has determined that unplanned deck and subsea spills represents a low current risk rating and is unlikely to result in a risk consequence greater than Slight. A number of BIAs for EPBC Act listed Threatened or Migratory species overlap the Operational Area (refer to **Section 4.6**). 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 identified during impact assessment.

Further opportunities to reduce the impacts have been investigated above. The potential risks and consequences are considered acceptable if the adopted controls are implemented. Therefore, Woodside considers the adopted controls appropriate to manage the risks and consequences of an unplanned discharge of chemicals /hydrocarbons to a level that is broadly acceptable.

Environmental Performance Outcomes, Standards and Measurement Criteria			
EPO	***Adopted Control(s)***	***EPS***	***MC***
EPO 3 Undertake the Petroleum Activities Program in a manner that does not result in a substantial change in water quality which may adversely impact on biodiversity, ecological integrity, social amenity or human health.	**C 10.1** **See Section 6.7.3**	**PS 10.1** **See Section 6.7.3**	**MC 10.1.1** **See Section 6.7.3**
	C 11.1 Liquid chemical and fuel storage areas are bunded or secondarily contained when they are not being handled/moved temporarily.	**PS 11.1** Failure of primary containment in storage areas does not result in loss to the marine environment.	**MC 11.1.1** Inspection confirms liquid chemicals and fuel are stored in bunded/secondarily contained areas.
	C 11.2 Spill kits positioned in high risk locations around the vessel (near potential spill points such as transfer stations).	**PS 11.2** Spill kits available for use to clean up deck spills.	**MC 11.2.1** Records confirms that spill kits are present, maintained, and suitably stocked.
	C 11.3 Implementation of waste management procedures which provide for safe handling and transportation, segregation and storage and appropriate classification of all waste generated.	**PS 11.3** Hazardous and non hazardous waste managed in accordance with the waste management procedure.	**MC 11.3.1** Records demonstrate compliance with waste management procedure.
	C 7.4 **See Section 6.6.7**	**PS 7.4** **See Section 6.6.7**	**MC 7.4.1** **See Section 6.6.7**
	C 11.4 Below-deck storage of hydrocarbons and chemicals where practicable.	**PS 11.4** Hydrocarbons and chemicals stored below-deck where practicable.	**MC 11.4.1** Inspections show storage where practicable of hydrocarbons and chemicals below deck

6.7.5 Unplanned Discharge – Hazardous and Non-Hazardous Solid Waste / Equipment

Scarborough OPP – Relevant Impact Assessment Section
Section 7.2.2 – Unplanned Discharge: Solid Waste

Context		
Relevant Activities Vessel Operations – **Section 3.7**	**Existing Environment** Marine Regional Characteristics – **Section 4.2**	**Stakeholder consultation** Consultation – **Section 5** No stakeholder concerns have been raised with respect to unplanned discharge of waste or potentially impacted receptors.

Impact/Risk Evaluation Summary

Source of Impact/Risk	***Environmental Value Potentially Impacted***							***Evaluation***						
	Soil and Groundwater	**Marine Sediment**	**Water Quality**	**Air Quality (inc. odour)**	**Ecosystems / Habitat**	**Species**	**Socio-economic**	**Decision Type**	**Impact/Consequence**	**Likelihood**	**Current Risk Rating**	**ALARP Tools**	**Acceptability**	**Outcome**
Accidental loss of hazardous or non-hazardous solid wastes / equipment to the marine environment			✓			✓		A	D	0	L	LCS GP PJ	Broadly Acceptable	EPO 3,6,10,11,12,15,21,22,23

Description of Source of Impact/Risk
The 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 may also be dropped or blown overboard. Equipment that has been recorded as being lost on previous campaigns 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.

Detailed Impact Assessment
Assessment of Potential Impacts
The potential impacts of hazardous or non-hazardous solid wastes and equipment accidentally discharged to the marine environment include contamination of the environment as well as secondary impacts relating to potential contact of marine fauna with wastes. This could result in entanglement or ingestion and lead to injury and death of individual animals and changes to aesthetic values. The temporary or permanent loss of waste materials / equipment into the marine environment is not likely to have a significant environmental impact, based on the location of the PAA, the types, size and frequency of wastes that could occur, and species present. ***Water Quality***

Change in Water Quality

Hazardous solid wastes such as paint cans, oily rags, etc., can cause localised contamination of the water through a release of toxins and chemicals. Given the likely small volumes of any unplanned solid waste discharge, and the occasional nature of the event, these would result in temporary and highly localised changes to the water quality.

Seabirds and Migratory Shorebirds, Fish, Marine Reptiles and Marine Mammals

Injury/Mortality to Fauna

The unplanned discharge of solid wastes can result in injury or mortality to fauna, either through contamination or physical injury depending on the nature of the waste. Ingestion or entanglement of marine fauna has the potential for physical harm, which may limit feeding/foraging behaviours and thus can result in mortalities. Injury and fatality to vertebrate marine life caused by ingestion of, or entanglement in, harmful marine debris was listed as a key threatening process under the EPBC Act in August 2003 (Commonwealth of Australia, 2018). The Threat Abatement Plan for the impacts of marine debris on the vertebrate wildlife of Australia's coasts and oceans (Commonwealth of Australia, 2018) identifies EPBC Act-listed species for which there are scientifically documented adverse impacts resulting from marine debris. Marine turtles and seabirds in particular may be at risk from plastics, which may cause entanglement or be mistaken for food (e.g. Commonwealth of Australia, 2018; Commonwealth of Australia, 2017a) and ingested causing damage to internal tissues and potentially preventing feeding activities. In the worst instance this could have a lethal affect to an individual. Marine debris has been identified as threat in the Recovery Plan for Marine Turtles in Australia (2017–2027).

Impacts to species including fish, birds, marine mammals and marine reptiles from the unplanned discharge of solid waste is unlikely given low occurrence of unplanned discharges. Significant impacts are unlikely to occur at an individual level and will not occur at a population level, nor result in the decrease of the quality of the habitat such that the extent of these species is likely to decline.

While, the threat abatement plan for impacts of marine debris on vertebrate marine life does not list explicit management actions for non-related industries (DEWHA, 2009), management controls will reduce the risk of unplanned discharge of solid waste.

The temporary or permanent loss of waste materials into the marine environment is not likely to have a significant environmental impact, based on the types, size and frequency of wastes that could occur. The magnitude of potential impact to marine fauna is Slight, which results in a consequence of Minor (D) based on the high receptor sensitivity.

Summary of Assessment Outcomes

Receptor	Impact	Receptor Sensitivity	Risk Consequence	Likelihood	Risk Rating
Water quality	Change in water quality	Low value (open water)	Negligible (F)	Remote	Low
Fish, sharks and rays	Injury/mortality to marine fauna	High value species (e.g. whale shark)	Minor (D)	Remote	Low
Marine mammals		High value species (e.g. pygmy blue whale)	Minor (D)	Remote	Low
Marine reptiles		High values species (e.g. flatback, green and hawksbill turtle)	Minor (D)	Remote	Low
Seabirds and migratory shorebirds		High value species	Minor (D)	Remote	Low

Overall Risk Consequence: The overall risk consequence/risk rating for unplanned discharge of waste is Low based on a Minor consequence to the high value receptors (marine fauna). The risk consequence/risk ratings for individual receptors are consistent with the levels rated in the Scarborough OPP.

Demonstration of ALARP				
Control Considered	***Control Feasibility (F) and Cost/Sacrifice (CS)***	***Benefit in Impact/Risk Reduction***	***Proportionality***	***Control Adopted***
Legislation, Codes and Standards				
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 7.1**
Good Practice				
Marine Order 94 – Packaged harmful substances, which requires: • Vessels carrying harmful substances in packaged form must comply with 2 to 5 of MARPOL Annex III, with respect to stowage requirements. • A vessel Master may only wash a substance overboard if: - the physical, chemical and biological properties of the substance have been considered, and - washing overboard is considered the most appropriate manner of disposal, and - the Vessel Master has authorised the washing overboard.	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 12.1**
Implementation of waste management procedures which provide for safe handling and transportation, segregation and storage and appropriate classification of all waste generated.	F: Yes. CS: Minimal cost. Standard practice.	Controls outlined in the management plan will reduce the likelihood of an unplanned release. The consequence is unchanged.	Benefit outweighs cost sacrifice.	Yes **C 11.3**
Vessel ROV, crane or support vessel may be used to attempt recovery of hazardous solid wastes lost overboard. Where safe and practicable for this activity will consider: • risk to personnel to retrieve object	F: Yes. CS: Minimal cost. Standard practice.	Occurs after an unplanned release of solid waste and therefore no change to the likelihood. Since the waste objects may be recovered, a reduction in	Benefit outweighs cost sacrifice.	Yes **C 12.2**

• whether the location of the object is in recoverable water depths • object's proximity to subsea infrastructure • ability to recover the object (i.e., nature of object, lifting equipment or, ROV availability and suitable weather).		consequence is possible.		
Professional Judgement – Eliminate				
No additional controls identified.				
Professional Judgement – Substitute				
No additional controls identified.				
Professional Judgement – Engineered Solutions				
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 2.3.3**), Woodside considers the adopted controls appropriate to manage the risks and consequences of unplanned discharge 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 Criteria and Assessment
The Petroleum Activities Program meets the acceptability criteria (**Section 2.3.5**): • Overall risk consequence/risk ratings for individual receptors are consistent with the levels rated in the Scarborough OPP. • EPOs and controls in the Scarborough OPP that are relevant to an unplanned release of hazardous and non-hazardous wastes have been adopted. • There are no changes to internal/external context specific to this risk from the Scarborough OPP, including issues raised during stakeholder consultation.
Acceptability Statement: The impact assessment has determined that unplanned discharges from a release of solid hazardous and non-hazardous wastes represents a low current risk rating and is unlikely to result in a risk consequence greater than Minor. A number of BIAs for EPBC Act listed Threatened or Migratory species overlap 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. 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 identified during impact assessment. Further opportunities to reduce the impacts have been investigated above. The potential risks and consequences are considered acceptable if the adopted controls are implemented. Therefore, Woodside considers the adopted controls appropriate to manage the risks and consequences of an unplanned discharge of hazardous and non-hazardous solid waste / equipment to a level that is broadly acceptable.

Environmental Performance Outcomes, Standards and Measurement Criteria			
EPO	***Adopted Control(s)***	***EPS***	***MC***
EPO 3	**C 7.1**	**PS 7.1**	**MC 7.1.1**

Environmental Performance Outcomes, Standards and Measurement Criteria			
EPO	***Adopted Control(s)***	***EPS***	***MC***
Undertake the Petroleum Activities Program in a manner that does not result in a substantial change in water quality which may adversely impact on biodiversity, ecological integrity, social amenity or human health. **EPO 6** Undertake the Petroleum Activities Program in a manner that will not modify, destroy, fragment, isolate or disturb an important or substantial area of habitat such that an adverse impact on marine ecosystem functioning or integrity results. **EPO 10** Undertake the Petroleum Activities Program in a manner that will not have a substantial adverse effect on a population of seabirds or shorebirds, or the spatial distribution of the population. **EPO 11** Undertake the Petroleum Activities Program in a manner that will not seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of a migratory species. **EPO 15** Undertake the Petroleum Activities Program in a manner that prevents a substantial adverse effect on a population of fish, marine mammals, marine reptiles, or the spatial distribution of a population. **EPO 12** Undertake the Petroleum Activities Program in a manner that will not substantially modify, destroy or isolate an area of important habitat for a migratory species.	**See Section 6.6.7**	**See Section 6.6.7**	**See Section 6.6.7**
	C 12.1 Marine Order 94 (where relevant to vessel class) – packaged harmful substances, which requires: • vessels carrying harmful substances in packaged form must comply with 2 to 5 of MARPOL Annex III, with respect to stowage requirements • a Vessel Master may only wash a substance overboard if: • the physical, chemical and biological properties of the substance have been considered, and • washing overboard is considered the most appropriate manner of disposal, and • the Vessel Master has authorised the washing overboard.	**PS 12.1** Compliance with Marine Order 94 (where relevant to vessel class) – packaged harmful substances which provides information about preventing harmful substances carried by regulated Australian vessels, from entering the marine environment.	**MC 12.1.1** Records demonstrate any non-compliance with Marine Orders are documented.
	C 11.3 **See Section 6.7.4**	**PS 11.3** **See Section 6.7.4**	**MC 11.3.1** **See Section 6.7.4**
	C 12.2 Vessel ROV, crane or support vessel may be used to attempt recovery of solid wastes / equipment lost overboard. Where safe and practicable for this activity will consider: • risk to personnel to retrieve object • whether the location of the object is in recoverable water depths • object's proximity to subsea infrastructure • ability to recover the object (i.e., nature of object, lifting equipment or, ROV availability and suitable weather).	**PS 12.2** Any solid waste / equipment dropped to the marine environment will be recovered where safe and practicable to do so.	**MC 12.2.1** Records detail the recovery attempt consideration and status of any waste / equipment lost to marine environment.

Environmental Performance Outcomes, Standards and Measurement Criteria			
EPO	***Adopted Control(s)***	***EPS***	***MC***
EPO 21 Undertake Petroleum Activities Program in a manner that will prevent an unplanned release of solid waste to the marine environment resulting in a significant impact. **EPO 22** Undertake the Petroleum Activities Program in a manner that will prevent a substantial adverse effect on a population of fish, or the spatial distribution of the population. **EPO 23** Undertake the Petroleum Activities Program in a manner that will prevent a substantial adverse effect on a population of marine mammals or the spatial distribution of the population.			

6.7.6 Physical Presence (Unplanned) – Seabed Disturbance

Scarborough OPP – Relevant Impact Assessment Section		
Section 7.2.3 – Physical Presence (Unplanned): Seabed Disturbance		
Context		
Relevant Activities Vessel Operations – **Section 3.7** Seabed Intervention Activities – **Section 3.9** Trunkline Installation Activities – **Section 3.11**	**Existing Environment** Marine Regional Characteristics – **Section 4.2** Physical Environment – **Section 4.4** Habitats and Biological Communities – **Section 4.5**	**Stakeholder consultation** Consultation – **Section 5**

Impact/Risk Evaluation Summary

Source of Impact/Risk	*Environmental Value Potentially Impacted*							*Evaluation*						
	Soil and Groundwater	**Marine Sediment**	**Water Quality**	**Air Quality (inc. odour)**	**Ecosystems / Habitat**	**Species**	**Socio-economic**	**Decision Type**	**Impact/Consequence**	**Likelihood**	**Current Risk Rating**	**ALARP Tools**	**Acceptability**	**Outcome**
Unplanned disturbance to seabed from trenching, spoil disposal and , backfill activities outside designated areas		✓	✓		✓		✓	A	D	2	M	LCS GP PJ	Broadly Acceptable	EPO 6,17,24
Dredging outside of Offshore Borrow Ground Project Area		✓	✓		✓			A	D	2	M			
Dropped objects resulting in the disturbance of benthic habitat		✓	✓		✓		✓	A	F	2	L			
Placement of rock berms, span correction or other seabed intervention works outside of design footprint		✓	✓		✓			A	D	2	M			
Unplanned seabed disturbance during continental slope preparation.		✓	✓		✓			A	D	2	M			

Anchoring of SWLB outside of predetermined safe zones		✓	✓		✓			A	D	2	M			
Contingent activities such as Trunkline abandonment and temporary mooring		✓	✓		✓			A	E	2	M			

Description of Source of Impact/Risk

Seabed Disturbance outside the Designated Area

- Trunkline trenching, spoil disposal and backfill activities may occur outside of the designated area as a result of operator error, equipment failure, unplanned movement of the seabed, adverse weather conditions or sea states and in the event of contingency activities.
- Dredging outside Offshore Borrow Ground Project Area may occur as a result of operator error, adverse weather conditions or sea states.
- Rock berm placement, span rectification and other seabed intervention activities may occur outside of the designated project footprint, as a result of operator error, adverse weather conditions or sea states.
- Unplanned seabed disturbance during continental slope preparation and excavation activities could result from turbid flow due to the mobile nature of the seabed soft sediments, coupled with the slope angle.
- Anchoring of SWLB outside predetermined safe zones may occur outside of the designated area as a result of operator error, adverse weather conditions or sea states.
- Contingent Trunkline installation activities: The trunkline may need to be abandoned and retrieved multiple times throughout installation as a result of adverse sea states, cyclones, or mechanical issues with pipelay (**Section 3.12.3**). Abandonment must occur within a straight line, therefore if abandonment occurs at a bend in the trunkline route, lay-down on the seabed may occur outside of the expected trunkline footprint. The catenary of trunkline to be abandoned is nominally 2.5 times the water depth. The trunkline will be retrieved and thus impacts to the seafloor will be temporary in nature.

Dropped Objects

There is the potential for objects to be dropped overboard from 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) and hardware fixtures; however, there is also potential for larger equipment to also be dropped during the activity. The spatial extent in which dropped objects can occur is restricted to the Operational Area.

Temporary mooring

In the event of a contingency activity (**Section 3.12**) the PV may be required to temporarily moor on location via anchor. The expected footprint of seabed disturbance due to setting the anchor is minimal, due to activity being short term. Impacts are likely to be constrained to the area and temporary. Typically, the PV uses DP to remain in location.

Detailed Impact Assessment

Assessment of Potential Impacts

It is expected that any unplanned seabed disturbance would be within the 12.9 km^2 seabed disturbance calculation, as defined within the Scarborough OPP (SA0006AF0000002, Rev 5), based on an average 30 m trunkline disturbance corridor, along the length of the trunkline (430 km).

Water and Sediment quality

Water quality change occurs when seabed sediments enter the water column (turbidity). Turbidity may occur during any activity which requires contact with, or occurs in close proximity to, the seabed. After a period, the suspended sediments settle and the turbidity in the water column returns to pre-disturbance levels. Sediment sampling along the proposed pipeline route has demonstrated that sediments are suitable for unconfined ocean disposal with results indicating that all levels of potential contaminants of concern were below the NAGD (2009) screening levels. Therefore, sediments to be dredged (and suspended during operations) are considered to be uncontaminated and thus no toxicological impacts to water and sediment from the resuspension of contaminants are predicted.

Impacts from unplanned seabed disturbance outside the designated area on water and sediment quality will be slight. Receptor sensitivity of water quality is low (low value, open water), and impacts are expected to be localised.

Epifauna and Infauna

The seafloor within the region is understood to comprise of soft sediments for the majority, with the presence of a rock pinnacle field at 300 m depth. The pinnacles are isolated forms, approximately 350 m south of the trunkline at KP209, and do not constitute a continuous reef, however provide habitat for a diverse range of epifaunal and demersal species that commonly occur across the NWMR, as well a low density of soft corals on top. Epifauna and benthic habitats are likely to be sparse, comprising of ascidians, sponges, invertebrate communities and octocorals representative of the wider region, as well as larger motile organisms (demersal fish, shrimp, sea cucumbers etc.) and infauna (i.e. polychaetes) (**Section 4.5**). These communities are well represented through the region, and any impacts are likely to be at a localised proportion of communities (Keesing, 2019; Advisian, 2019a).

The proposed trunkline route avoids areas of potentially high diversity, relative to the surrounding area such as the rock pinnacles. However, should seabed disturbance occur outside of the designated area as a result of trunkline abandonment or incorrect trunkline installation or dredging, backfill activities or spoil disposal, there may be a localised impact on benthic communities that may occur within the wider Operational Area. Dropped objects and temporary mooring can disturb the seabed, resulting in habitat change and alter communities. If not recovered due to health and safety, operational constraints or other factors, dropped objects may result in a small permanent loss of habitat under the object. In most cases, these objects will be able to be recovered and the impacts will be temporary in nature.

KEFs

Three KEFs overlap the Trunkline Project Area; the Exmouth Plateau, Ancient Coastline at 125 m Depth and Continental Slope Demersal Fish Community. Unplanned disturbance may lead to localised and temporary change in habitat and subsequent localised impact on benthic communities.

The Trunkline Project Area enters the Exmouth Plateau KEF about 240 km offshore (Figure 4-10) within water depths of about 1100 m, extending about 60 km into the KEF. The Ancient Coastline at 125 m Depth KEF overlaps the Trunkline Project Area, located about 360 km offshore (**Figure 4-10**), north-north-west of the Montebello Islands. Trunkline trenching, backfill and slope crossing excavation will not occur in these KEFs; any unplanned seabed disturbance will be restricted to the small footprint of an object potentially dropped and will be highly localised. Impact will not occur to the hard substrates of the KEF. Physical habitat modification is not listed as a potential concern for this KEF.

The Continental Slope Demersal Fish Community is recognised as a KEF because of its biodiversity values, including high levels of endemism (DAWE, 2020). The Trunkline Project Area intersects a small portion of the KEF (**Figure 4-10**), across one of its thinnest points throughout its distribution. Physical habitat modification is listed as a potential concern for this KEF (DAWE, 2020). Trunkline trenching, backfill and slope crossing excavation will not occur in this KEF, any potential impact to the KEF from unplanned habitat disturbance is restricted to the footprint of a dropped object and will be highly localised.

AMPs

The offshore borrow ground dredging will occur adjacent to the Dampier Marine Park. A planned 250 m buffer is in place, as described in **Section 6.6.2**. Should dredging occur outside of the designated areas it is not anticipated to be at a significant distance and impacts will remain within this buffer zone (i.e. seabed disturbance will not be within the Dampier Marine Park or outside of the modelled impact area (**Section 6.6.2**)). Elevated suspended sediment concentrations (SSCs) and hence detectable changes in water quality may occur within the Dampier Marine Park, however this will be temporary and not expected to modify, destroy, fragment, isolate or disturb an important or substantial area of habitat.

The Trunkline Project Area intersects the Montebello Marine Park between KP 109 to KP191 and within this area span rectification for three infrastructure crossings will occur. There is the potential for these activities to occur outside of their designated areas. Dominant benthic organisms recorded within the section of the Trunkline Project Area intersecting the Marine Park have included a wide variety of sponges and soft corals including whips and gorgonians, hydroids, seapens and crinoids (Advisian, 2019a), however these are typical of the benthos found both within the Marine Park (Advisian, 2019a) and regionally (Keesing, 2019). The footprint of free span rectification is extremely small in comparison with the spatial extent of these communities in the north western section of the Montebello Marine Park, the any unplanned seabed disturbance will not destroy, fragment, isolate these communities.

Unplanned seabed disturbance, should it increase suspended sediment concentrations within the Montebello Marine Park, does have the potential to indirectly affect filter feeder-sponge habitat. However, a minor temporary increase in suspended sediments at the seabed associated with an unplanned seabed disturbance within the Montebello Marine Park would not reach the intensity and duration terms of the impact thresholds, as discussed in **Section 6.6.2** and thus no impacts are predicted beyond the direct footprint.

Summary of Assessment Outcomes					
Receptor	**Impact**	**Receptor Sensitivity**	**Consequence**	**Likelihood**	**Risk Rating**
Water quality	Change in water quality	Low value	Negligible (F)	Highly Unlikely	Low
Sediment quality	Change in sediment quality	Low value	Negligible (F)	Highly Unlikely	Low
Epifauna and infauna	Change in habitat Injury/mortality to marine fauna	Low value	Negligible (F)	Highly Unlikely	Low
KEFs	Change in habitat	High Value	Minor (D)	Highly Unlikely	Moderate
AMPs	Change in habitat	High Value	Minor (D)	Highly Unlikely	Moderate
Overall Risk Consequence: The overall risk consequence/risk rating for unplanned seabed disturbance is Moderate based on a Minor consequence to the high value receptors (KEFs and AMPs). The risk consequence/risk ratings for individual receptors are consistent with the levels rated in the Scarborough OPP.					

Demonstration of ALARP				
Control Considered	***Control Feasibility (F) and Cost/Sacrifice (CS)***	***Benefit in Impact/Risk Reduction***	***Proportionality***	***Control Adopted***
Legislation, Codes and Standards				
No additional controls identified.				
Good Practice				
A 250 m buffer zone will be implemented between the offshore borrow ground and the Dampier AMP.	F: Yes. The implementation of the buffer is feasible whilst ensuring there is enough sand available for the backfill activities. Increasing the buffer may limit the sand available for backfill resulting in the use of an additional borrow ground. CS: Minimal sacrifice	This control would reduce the risk of potential direct disturbance with the Dampier Marine Park.	The control would significantly reduce the risk of direct disturbance within the Dampier Marine Park	Yes **C 2.3**
The vessels work procedures for lifts, bulk transfers and cargo loading, which require: • The security of loads shall be checked prior to 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	F: Yes. CS: Minimal cost. Standard practice.	Occurs after a dropped object event and therefore no change to the likelihood. Since the object may be recovered, a reduction in consequence is possible.	Benefits outweigh cost/sacrifice.	Yes **C 13.1**

Demonstration of ALARP				
Control Considered	***Control Feasibility (F) and Cost/Sacrifice (CS)***	***Benefit in Impact/Risk Reduction***	***Proportionality***	***Control Adopted***
manage the specific risks of that lift, including consideration of weather and sea state.				
Vessel inductions include awareness for crew in dropped object prevention.	F: Yes. CS: Minimal cost. Standard practice.	By ensuring crew are appropriately inducted in dropped object prevention, the likelihood of a dropped object event is reduced. No change in consequence will occur.	Benefits outweigh cost/sacrifice.	Yes **C 13.2**
Infrastructure will be placed on the seabed within the design footprint using positioning technology	F: Yes. This is a standard practice and benefits project requirements aiding placement as per design requirements. CS: Costs associated with improved accuracy/tolerance for implementation	Positioning infrastructure within the design footprint will reduce the potential magnitude of impact.	Benefits outweigh cost/sacrifice	Yes **C 3.1**
Dropped objects to be recovered and relocated where safe and practicable to do so.	F: May not always be possible. Assessed case by case. CS: Potentially significant cost. Standard practice.	Occurs after a dropped object event; therefore, no change to the likelihood. Since the object may be recovered, a reduction in consequence is possible.	Benefits outweigh cost/sacrifice.	Yes **C 13.3**
Comply with in force Sea Dumping Permit (No. SD2019/3982 or amended), which includes the following: • Contractor must only dump within the disposal site. • Contractor must ensure the dredged material is dumped in a manner over the disposal site to minimise mounding from dumping activities. • Contractor must establish by GPS that, prior to dumping, the vessel is within the disposal site.	F: Yes CS: Significant costs associated with the studies and development of a sea dumping permit.	Implementation of the control provides regulation of sea dumping and includes an impact assessment to ensure environmental impact is minimised.	Control based on legislative requirements – must be adopted.	Yes **C 2.1**
Designated 'No dredge' out of zone alarms will be in use on the dredging vessel navigation system.	F: Yes. CS: Minimal cost. Standard practice.	Use of out of zone alarms will reduce the likelihood of seabed	Benefits outweigh cost/sacrifice.	Yes **C 13.4**

Demonstration of ALARP				
Control Considered	***Control Feasibility (F) and Cost/Sacrifice (CS)***	***Benefit in Impact/Risk Reduction***	***Proportionality***	***Control Adopted***
		disturbance outside designated areas. No change in consequence will occur.		
The trunkline touch down point will be monitored during operations to ensure the trunkline is installed correctly.	F: Yes. CS: Minimal cost. Standard practice.	Monitoring of the touch down point will ensure the trunkline is installed in the correct position and does not result in seabed disturbance outside the defined trunkline corridor.	Benefits outweigh cost/sacrifice.	Yes **C 13.5**
Professional Judgement – Eliminate				
Use of automated spreader bars for pipe lifting / transfer to PV	F: Yes. CS: Monetary cost of system design and installation.	Use of spreader bars eliminates the use of slings, which may be prone to slippage. This can reduce the likelihood of dropped pipes	Benefits outweigh cost/sacrifice.	Yes **C 13.6**
Professional Judgement – Substitute				
No additional controls identified.				
Professional Judgement – Engineered Solutions				
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 2.3.3**), Woodside considers the adopted controls appropriate to manage the risks and consequences of unplanned seabed disturbance. 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 Criteria and Assessment
The Petroleum Activities Program meets the acceptability criteria (**Section 2.3.5**): • Overall risk consequence/risk ratings for individual receptors are consistent with the levels rated in the Scarborough OPP. • EPOs and controls in the Scarborough OPP that are relevant to an unplanned seabed disturbance have been adopted. • There are no changes to internal/external context specific to this risk from the Scarborough OPP, including issues raised during stakeholder consultation.
Acceptability Statement:

The impact assessment has determined that disturbance to seabed from dropped objects or seabed disturbance outside the designated area represents a moderate current risk rating and is unlikely to result in a risk consequence greater than Minor. The adopted controls are considered consistent with industry good practice and professional judgement. Further opportunities to reduce the impacts have been investigated above. The potential risks and consequences are considered acceptable if the adopted controls are implemented. Therefore, Woodside considers the adopted controls appropriate to manage the risks and consequences of unplanned seabed disturbance to a level that is broadly acceptable.

Environmental Performance Outcomes, Standards and Measurement Criteria			
EPO	***Adopted Control(s)***	***EPS***	***MC***
EPO 6 Undertake the Petroleum Activities Program in a manner that will not modify, destroy, fragment, isolate or disturb an important or substantial area of habitat such that an adverse impact on marine ecosystem functioning or integrity results. **EPO 17** Undertake the Petroleum Activities Program in a manner which does not modify, destroy, fragment, isolate or disturb an important or substantial area of habitat such that an adverse impact on marine ecosystem functioning or integrity an area defined as a KEF. **EPO 24** Undertake the Petroleum Activities Program in a manner which prevents unplanned seabed disturbance.	**C 2.3** **See Section 6.6.2**	**PS 2.3** **See Section 6.6.2**	**MC 2.3.1** **See Section 6.6.2**
	C 13.1 The vessels work procedures for lifts, bulk transfers and cargo loading, which require: • the security of loads shall be checked prior to 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.	**PS 13.1** All lifts conducted in accordance with applicable vessels work procedures to limit potential for dropped objects.	**MC 13.1.1** Records show lifts conducted in accordance with the applicable vessel work procedures.
	C 13.2 Vessel inductions include awareness for crew in dropped object prevention.	**PS 13.2** Aropped object prevention awareness is provided to the vessel crew.	**MC 13.2.1** Records show dropped object prevention awareness is provided to the vessel crew.
	C 3.1 **See Section 6.6.3**	**PS 3.1** **See Section 6.6.3**	**MC 3.1.1** **See Section 6.6.3**
	C 13.3 Dropped objects to be recovered and relocated where safe and practicable to do so.	**PS 13.3** Dropped objects are recovered and relocated where safe and practicable to do so.	**MC 13.3** Records demonstrate that attempts have been made to recover and relocate dropped objects where safe and practicable to do so.
	C 2.1 **See Section 6.6.2**	**PS 2.1.1** **See Section 6.6.2**	**MC 2.1.1** **See Section 6.6.2**
		PS 2.1.2 **See Section 6.6.2**	**MC 2.1.2** **See Section 6.6.2**
	C 13.4 Designated 'No dredge' out of zone alarms will be	**PS 13.4** Designated 'No dredge' out of zone alarms are in place	**MC 13.4.1**

Environmental Performance Outcomes, Standards and Measurement Criteria			
EPO	***Adopted Control(s)***	***EPS***	***MC***
	installed and used on the dredging vessel navigation system.	and operational on the dredging vessel navigation system.	Inspection demonstrate alarms in place and operational
	C 13.5 The trunkline touch down point will be monitored during operations to ensure the trunkline is installed correctly.	**PS 13.5** Trunkline touchdown point monitored during pipelay operations and is laid in the designated area.	**MC 13.5.1** Records demonstrate the trunkline touchdown point is monitored during pipelay operations and is laid in the designated area.
	C 13.6 Use of automated spreader bars for pipe lifting / transfer to PV.	**PS 13.6** Pipe transfers carried out using automated spreader bars to replace slings on the PV.	**MC 13.6.1** Records demonstrate automated spreader bars used on the PV.

6.7.7 Physical Presence (Unplanned) – Interaction with Marine Fauna

Scarborough OPP – Relevant Impact Assessment Section		
Section 7.2.5 – Physical Presence (Unplanned): Collision with Marine Fauna		
Context		
Relevant Activities Vessel Operations – **Section 3.7** Seabed Intervention Activities – **Section 3.9** Trunkline Installation Activities – **Section 3.11**	**Existing Environment** Protected Species – **Section 4.6**	**Stakeholder consultation** Consultation – **Section 5** No stakeholder concerns have been raised with respect to interaction with marine fauna due to physical presence of the Petroleum Activities Program.

Impact/Risk Evaluation Summary

Source of Impact/Risk	*Environmental Value Potentially Impacted*							*Evaluation*						
	Soil and Groundwater	Marine Sediment	Water Quality	Air Quality (inc. odour)	Ecosystems / Habitat	Species	Socio-economic	Decision Type	Impact/Consequence	Likelihood	Current Risk Rating	ALARP Tools	Acceptability	Outcome
Accidental collision between project vessels and protected marine fauna						✓		A	E	1	L	LCS GP PJ	Broadly Acceptable	EPO 6,10,15,23,25
Accidental entrainment of marine fauna from pre-lay trenching and dredging in Offshore Borrow Ground.						✓		A	E	1	L			
Accidental smothering/burial of marine fauna from spoil disposal and backfill.						✓		A	F	1	L			

Description of Source of Impact/Risk

Vessel Operations

Vessels operating within the Operational Area may present a potential hazard to marine mammals 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 or serious injury that may affect life functions (e.g. movement and reproduction) or cause 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 marine fauna present and their behaviours.

Several vessel types will be required to complete the activities associated with the Petroleum Activities Program, including larger vessels associated with installation and construction, and smaller support vessels (refer to **Section 3.9** and **3.11**).

Vessels within the Operational Area will be continuously moving at varying speeds, particularly within the Offshore Borrow Ground Project Area where vessel presence is limited to approximately two hours at a time. Project vessels within the Operational Area are likely to be travelling <8 knots (and will often be stationary), unless operating in an emergency. At times, vessels will be transiting within the Operational Area or to and from supply base where speed could be up to a maximum of about 15 knots, however are transitory through the area.

TSHD Activities

Dredging and trenching activities within the Trunkline Project Area and Offshore Borrow Ground Project Area have the potential to entrain fish and protected marine fauna such as marine turtles, through the unintentional removal of organisms by the suction field created by the TSHD (Reine and Clarke, 1998). Entrainment rates depend on a number of factors, including depth, dredger type, speed, and strength of suction field (Todd et al., 2014). The TSHD will sail slowly, typically at 1-1.5m/s during trunkline and borrow ground dredging.

Detailed Impact Assessment

Assessment of Potential Impacts

Unplanned interaction with marine fauna has the potential to occur within the Operational Area. There are a number of EPBC listed species with the potential to occur within the Operational Area (**Section 4.6**). The BIAs and Habitat Critical to the survival of the species that overlap the Operational Area are summarised below:

- A pygmy blue whale migration BIA overlaps with deeper waters within the Trunkline Project Area. There is a higher likelihood of pygmy blue whale presence from April–July and October–January during their seasonal migrations. This BIA overlaps the location of slope crossing seabed preparation activities.
- A humpback whale migration BIA overlaps with the Operational Area. Humpback whales are expected to be most frequently encountered during the trenching and material disposal and Offshore Borrow Ground dredging and backfill, particularly during annual migrations ((July (northbound) and late August/September (southbound)).
- Flatback, green and hawksbill turtle internesting buffer BIAs and internesting Habitat Critical, and loggerhead turtle internesting buffer BIAs overlap with the Operational Area. Activities in proximity to these locations are limited to the works along the trunkline route (KP 32 to KP 50), the cycling of dredging and backfill between the Offshore Borrow Ground Project Area, Trunkline Project Area (KP 32 to KP 50), and disposal of material in Spoil Ground 5A.
- A whale shark foraging BIA overlaps the Trunkline Project Area at KP 50. Activities within the BIA are limited to span rectification and surveys.

Marine Mammals

Cetaceans are naturally inquisitive marine mammals. The reaction of cetaceans to the approach of a vessel is quite variable. Some species remain motionless when close to a vessel, while others are known to be curious and often approach ships that have stopped or are slow moving, although they generally do not approach and sometimes avoid faster moving ships (Richardson et al., 1995). The Whale and Dolphin Conservation Society (WDCS, 2006), indicates that some cetacean species, such as humpback whales, can detect and change course to avoid a vessel.

Collisions between vessels and marine mammals occur more frequently in areas where high vessel traffic and important habitat coincide (WDCS, 2006). In Australia, the majority of vessel strikes to known species involved humpback, southern right whale and sperm whales, in descending order (Peel et al., 2016). Van Warebeek et al. (2007) report just five blue whale ship strikes in the Southern Hemisphere. No vessel strike collisions were reported in the northern coast of Australia (Peel et, al. 2016). The behaviour exhibited by whales prior to vessel collision varies, with some reported as being asleep/unmoving prior to the collision (Peel et al., 2016) and others displaying a 'last-second flight response' (Laist et al., 2001). Individual cetaceans engaged in behaviours such as feeding, mating or nursing may also be more vulnerable to vessel collisions when distracted by these activities (Commonwealth of Australia, 2017b).

The likelihood of vessel/whale collision being lethal is influenced by vessel speed—the greater the speed at impact, the greater the risk of mortality (Jensen and Silber, 2004; Laist et al., 2001). Vanderlaan and Taggart (2007) found that the chance of lethal injury to a large whale as a result of a vessel strike increases from about 20% at 8.6 knots to 80% at 15 knots. The risk of lethal injury to a large whale as a result of vessel strike is less than 10% at a speed of 4 knots (Vanderlaan and Taggart, 2007). Vessel-whale collisions at this speed are uncommon and, based on reported data contained in the NOAA database (Jensen and Silber, 2004) there only two known instances of collisions when the vessel was travelling at less than 6 knots; both of these were from whale-watching vessels that were deliberately positioned amongst whales.

During the pygmy blue whale and humpback whale migration individuals and/or small groups may be present in the Operational Area. Conservation Advice for the humpback whale and the Conservation Management Plan for the blue whale identify vessel disturbance and strike as a threat to the EPBC listed species (Commonwealth of Australia, 2015a; TSSC, 2015b).

Dugong are known to occur in and around seagrass growth areas. Vessel speed is understood to be the primary factor affecting vessel collision risk (Hodgson, 2004) with evidence showing dugongs fail to flee or evade the approach of fast vessels (Groom et al., 2004). Seagrasses have not been observed in the within the Operational Area and it is unlikely that large numbers of the species will be present.

Given the duration of activities within the Operational Area and the slow speeds at which project vessels operate, collisions with marine mammals are considered highly unlikely.

Marine Reptiles

The Recovery Plan for Marine Turtles in Australia (Commonwealth of Australia, 2017a) recognises vessel strikes and dredging as key threats to EPBC listed marine turtle species. Dredging activities have the potential to entrain turtles, resulting in superficial or serious injury that may affect life functions, or cause mortality. Marine turtles at the surface or in shallow waters are at risk of vessel collision.

Hazel and Gyuris (2006) reviewed vessel strike data from 1999-2002 on the Queensland east coast and found that during that period at least 65 turtles were killed annually as a result of collisions with vessels. Green turtles, followed by loggerhead turtles comprised the majority of vessel related records, and 72% of cases were adult or sub-adult turtles (Hazel and Gyuris, 2006). In Australian waters, all species of marine turtle have been involved in vessel strikes (Commonwealth of Australia, 2016).

The effect of vessel speed on turtle flee response can be significant. A study by Hazel et al. (2007) found that 60% of green turtles fled from vessels travelling at 2.2 knots (4 km/h) while only 4% fled from vessels travelling at 10.2 knots (19 km/h). When fleeing 75% of turtles moved away from the vessel's track, 8% swam along the vessel track and 18% crossed in front of the vessel. The study concluded that most turtles would be unlikely to avoid vessels travelling at speeds greater than around 2.2 knots (Hazel et al., 2007; Commonwealth of Australia, 2017a). Furthermore, the relatively small size of turtles and the significant time spent below the surface makes their observation by vessel operators extremely difficult or impossible. Green turtles observed by Hazel et al. (2009) generally only exposed the dorsal-anterior part of the head above the surface of the water and not for longer than two seconds.

Dredging activities can be a direct source of impact to marine turtles and other marine fauna if individuals become caught in the dredge equipment (entrainment), or if smothering/burial occurs during spoil disposal or backfill. Entrainment of turtles during dredging may result in injury or mortality (Dickerson et al., 1991). The risk is considerably reduced by use of standard mitigations and protection devices (Dickerson, 2004). The implementation of exclusion zones and observation zones for dredging, spoil disposal and backfilling will the minimise risk of entrainment and smothering/burial of marine turtles. Turtle deflection chains will also be installed to the TSHD drag head to reduce entrainment of turtle during dredging. Potential impacts from dredging are likely to affect individuals rather than cause a population level impact.

Within the Recovery Plan for Marine Turtles in Australia (Commonwealth of Australia, 2017a) there is reference to undertaking dredging in important internesting habitat outside peak nesting seasons. For the section of trunkline (i.e. KP 32 to KP 50) that requires trenching and backfilling, consideration has been be given to fauna mitigation methods such as the seasonal timing to limit disturbance to turtles, this has been considered within the ALARP assessment below.

The Operational Area overlaps with an internesting buffer BIA and Habitat Critical to the survival of flatback turtles. However, it is noted that the BIA and Habitat Critical are considered very conservative as they are based on the maximum range of internesting females, and most marine turtles are more likely to remain near their nesting beaches. The 60 km internesting buffer for flatback turtles in the Recovery Plan for Marine Turtles in Australia (Commonwealth of Australia, 2017a) is based primarily on the movements of tagged internesting flatback turtles along the NWS reported by Whittock et al. (2014), which found that flatback turtles may demonstrate internesting displacement distances up to 62 km from nesting beaches. However, these movements were confined to longshore movements in nearshore coastal waters or travel between island rookeries and the adjacent mainland (Whittock et al., 2014).

Whittock et al. (2016a) more precisely defined flatback turtle internesting habitat along the NWS. This study developed a habitat suitability map to identify areas where internesting flatback turtles may be present along the NWS, based on data compiled for a suite of environmental variables and satellite tracks of 47 internesting flatback turtles from five different mainland and island rookeries tracked over 1289 days. Whittock et al. (2016b) defined suitable interesting habitat as water 0–16 m deep and within 5–10 km of the coastline, while unsuitable internesting flatback habitat was defined as waters >25 m deep and >27 km from the coastline.

The evidence that suitable internesting habitat for flatback turtles is likely to be limited to relatively shallow waters within close proximity of the coastline is further supported by data from satellite telemetry of 11 flatback turtles after nesting on the Lacepede Islands (Thums et al., 2017). This study found that "*During the inter-nesting phase, flatback turtles remained at an average distance of 15.75 ± 12.25 km from West Lacepede Island, in water depths of 16 ± 3 m…*" (Thums et al., 2017).

Thus, there is no evidence to date to indicate flatback turtles swim out into deep offshore waters during the internesting period.

It is acknowledged that an increased number of turtles may be encountered during the Petroleum Activities Program within the vicinity of offshore islands/archipelagos during internesting/nesting seasons. It is expected that individuals will respond to vessel presence by avoiding the immediate vicinity of the vessels, and combined with low vessel speed, will reduce the likelihood of a vessel-turtle collision or entrainment during dredging activities. In addition, activities within sensitive turtle areas (BIAs and Habitat Critical to the survival) will be conducted over a period of months (**Section 4.6.2**), further reducing the potential for impact at the individual and population level.

Fish, Sharks and Rays

Boat strike is recognised by the Approved Conservation Advice for *Rhincodon typus* (whale shark) (TSSC, 2015a) as one of the threats to their recovery. Whale sharks are at risk from vessel strikes when feeding at the surface or in shallow waters (where there is limited option to dive). Whale sharks may traverse offshore NWS waters including the Operational Area during their migrations to and from Ningaloo Reef. However, it is expected that whale shark presence within the Operational Area would not comprise significant numbers and their presence would be transitory and of a short duration.

Smaller fish may also be at risk of injury or mortality from vessels through being caught in thrusters during station keeping operations (i.e. during DP). However, this is unlikely given the low presence of individuals, combined with the avoidance behaviour commonly displayed during station keeping operations.

Dredging activities can be a source of impact to demersal species such as sawfish through potential entrainment or if smothering/burial occurs during spoil disposal or backfill. The implementation of mitigations and protection devices outlined below will the minimise risk of entrainment and/or smothering/burial of demersal species and any impacts are likely to affect individuals rather than cause a population level impact.

Cumulative Impacts

There is potential for some cumulative impacts to marine fauna to occur as a result of overlap with the Scarborough Drilling and Completions Petroleum Activities Program and installation of the PLET, located at the northern extent of the Operational Area. Given the offshore waters and deep water depths (approx. 900 m), interaction with marine fauna is likely to be limited to individuals and/or small groups of transient cetaceans, with potential impacts expected to result in a behavioural disturbance, i.e. avoidance of the project vessels, with no lasting effect.

Summary of Assessment Outcomes

Receptor	Impact	Receptor Sensitivity	Consequence	Likelihood	Risk Rating
Marine mammals	Injury/mortality to marine fauna	High value species	Slight (E)	Highly Unlikely	Low
Marine reptiles	Injury/mortality to marine fauna	High value species	Slight (E)	Highly Unlikely	Low
Fish, sharks and rays	Change in fauna behaviour Injury/mortality to marine fauna	High value species	Slight (E)	Highly Unlikely	Low

Overall Risk Consequence: The overall risk consequence/risk rating for interaction with marine fauna is Low based on a Slight consequence to the high value receptors (marine fauna). The risk consequence/risk ratings for individual receptors are consistent with the levels rated in the Scarborough OPP.

Demonstration of ALARP

Control Considered	Control Feasibility (F) and Cost/Sacrifice (CS)	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[3]:	F: Yes. CS: Minimal cost. Standard practice.	Implementation of these controls will reduce the likelihood of a collision between a cetacean, whale	Controls based on legislative requirements – must be adopted.	Yes **C 14.1**

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

Demonstration of ALARP				
Control Considered	***Control Feasibility (F) and Cost/Sacrifice (CS)***	***Benefit in Impact/Risk Reduction***	***Proportionality***	***Control Adopted***
• Vessels will not travel greater than 6 knots within 300 m of a cetacean or turtle (caution zone) and not approach closer than 100 m from a whale. • 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 6 knots. • Vessels will not travel greater than 8 knots within 250 m of a whale shark and not allow the vessel to approach closer than 30 m of a whale shark.		shark or turtle occurring. The consequence of a collision is unchanged.		
Comply with in force Sea Dumping Permit (No. SD2019/3982 or amended), which includes the following: • Prior to the commencement of the dumping activities, Contractor must ensure that a check is undertaken, using binoculars from a high observation platform, for marine species within the observation zone. • If any marine species are sighted in the observation zone, must not commence dumping activities until either 10 minutes after the last marine species is observed in the observation zone, or the vessel has moved to another area of the disposal site where it can maintain a minimum	F: Yes. CS: Standard practice.	Implementation of these controls will reduce the likelihood of an interaction with marine fauna during spoil disposal. The consequence of a collision is unchanged.	Controls based on legislative requirements – must be adopted.	**Yes** **C 2.1**

Demonstration of ALARP				
Control Considered	***Control Feasibility (F) and Cost/Sacrifice (CS)***	***Benefit in Impact/Risk Reduction***	***Proportionality***	***Control Adopted***
distance of 300 metres between the vessel and any marine species.				
Installation of turtle deflection chains in front of the TSHD drag head.	F: Yes. Turtle deflection chains in front of the drag head will reduce likelihood of entrainment of turtle during dredging. CS: No significant additional cost	Implementation of these controls will reduce the likelihood of an entrainment turtle occurring as the chains will reduce entrainment. The consequence is unchanged.	Benefits outweigh cost/sacrifice.	Yes **C 14.5**
Good Practice				
The use of trained vessel crew as MFOs on B-Type vessels while the PV is operating in the PBW migration BIA during migration period (Apr-Jul & Oct-Jan), to watch for PBW and notify PV of cetacean presence / activity.	F: Yes. Vessel bridge crews already maintain a constant watch during operations so can be trained in, and carry out, cetacean observations. CS: Additional cost of training	Trained MFO's on vessel bridge can increase understanding of PBW presence in the area of the PV, with information assisting in decision making relating to cumulative noise reduction measures.	Benefits outweigh cost/sacrifice.	Yes **C 6.2**
The use of trained vessel crew as MFOs on the PV while operating in the PBW migration BIA during migration period (Apr-Jul & Oct-Jan), to watch for PBW and record cetacean presence / activity.	F: Yes. Vessel bridge crews already maintain a constant watch during operations so can be trained in, and carry out, cetacean observations. CS: Additional cost of training	Trained MFO's on vessel bridge can increase understanding of PBW presence in the area of the PV, with information assisting in decision making relating to cumulative noise reduction measures.	Benefits outweigh cost/sacrifice.	Yes **C 6.3**
The use of trained vessel crew as MFOs on the OCV while operating in the PBW migration BIA during migration period (Apr-Jul & Oct-Jan), to watch for PBW and record cetacean presence / activity.	F: Yes. Vessel bridge crews already maintain a constant watch during operations so can be trained in, and carry out, cetacean observations. CS: Additional cost of training	Trained MFO's on vessel bridge can increase understanding of PBW presence in the vicinity of the continental slope	Benefits outweigh cost/sacrifice.	Yes **C 6.4**
For TSHD operations during daylight hours (excluding transit) adherence to defined observation and exclusion zone: • Whales: observation zone 300 m; exclusion zone 100 m.	F: Yes. CS: Standard practice.	Implementation of these controls will reduce the likelihood of an interaction with marine fauna during PAP. The consequence of a collision is unchanged.	Benefits outweigh cost/sacrifice.	**Yes** **C 14.2**

Demonstration of ALARP				
Control Considered	***Control Feasibility (F) and Cost/Sacrifice (CS)***	***Benefit in Impact/Risk Reduction***	***Proportionality***	***Control Adopted***
• Dolphins: observation zone 150 m (except for material disposal operations where the observation zone is 300 m); exclusion zone 50 m. • Dugongs: observation zone 150 m (except for material disposal operations where the observation zone is 300m); exclusion zone 50 m. • Turtles: observation zone 100 m (except for material disposal operations where the observation zone is 300 m); exclusion zone 50 m.				
Professional Judgement – Eliminate				
No additional controls identified.				
Professional Judgement – Substitute				
No additional controls identified.				
Professional Judgement – Engineered Solutions				
For vessel operations in excess of six knots in the humpback whale migratory BIA between 1 August and 31 October (inclusive), trained vessel crew as MFO to monitor for whales from a high observation platform on the vessel using binoculars by day and thermal imaging equipment at night or in periods of low visibility. Vessels must not: • travel faster than six knots within 300 m of a whale • approach closer than 100 m from a whale. If a whale(s) shows any sign of being disturbed inside the distances specified, the vessel will immediately withdraw from the whale(s) at a constant speed of less than six knots.	F: Yes. Trained vessel crew would reduce the likelihood of a vessel interaction with marine fauna by identifying whales within close proximity to the moving vessel. CS: Additional cost for MFO training.	Use of trained vessel crew as MFO during dredging activities is a control to mitigate and reduce likelihood of interaction with marine fauna.	Benefits outweigh cost/sacrifice.	Yes **C 14.3**

Demonstration of ALARP				
Control Considered	***Control Feasibility (F) and Cost/Sacrifice (CS)***	***Benefit in Impact/Risk Reduction***	***Proportionality***	***Control Adopted***
At completion of dredge run (i.e. fill of hopper), stop dredge pumps as soon as practicable after the TSHD drag head is lifted from the seafloor.	F: Yes. Stopping dredge pumps as soon as practicable after the drag head is lifted from the seafloor will reduce likelihood of entrainment. CS: No additional cost	Implementation of this controls will reduce the likelihood of an entrainment and impact to turtle occurring due to stopping dredge once off the seafloor. The consequence is unchanged.	Benefits outweigh cost/sacrifice.	Yes **C 14.4**

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 2.3.3**), Woodside considers the adopted controls appropriate to manage the risks and consequences of unplanned interaction with marine fauna. 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 Criteria and Assessment

The Petroleum Activities Program meets the acceptability criteria (**Section 2.3.5**):

- Overall risk consequence/risk ratings for individual receptors are consistent with the levels rated in the Scarborough OPP.
- EPOs and controls in the Scarborough OPP that are relevant to an unplanned seabed disturbance have been adopted.
- There are no changes to internal/external context specific to this risk from the Scarborough OPP, including issues raised during stakeholder consultation.

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 is unlikely to result in a risk consequence to marine fauna greater than Slight. 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.

Further opportunities to reduce the impacts have been investigated above. The potential risks and consequences are considered acceptable if the adopted controls are implemented. Therefore, Woodside considers the adopted controls appropriate to manage the risks and consequences of interaction with marine fauna to a level that is broadly acceptable.

Environmental Performance Outcomes, Standards and Measurement Criteria			
EPO	***Adopted Control(s)***	***EPS***	***MC***
EPO 6 Undertake the Petroleum Activities Program in a manner that will not modify, destroy, fragment, isolate or disturb an important or substantial area of habitat such that an adverse	**C 14.1** EPBC Regulations 2000 – Part 8 Division 8.1 Interacting with	**PS 14.1.1** Compliance with EPBC Regulations 2000 – Part 8 Division 8.1 (Regulation 8.05 and 8.06) Interacting with cetaceans to minimise potential for vessel strike.	**MC 14.1.1** Records demonstrate no breaches with EPBC Regulations 2000 – Part 8 Division 8.1 Interacting with cetaceans.
		PS 14.1.2	**MC 14.1.2**

Environmental Performance Outcomes, Standards and Measurement Criteria			
EPO	***Adopted Control(s)***	***EPS***	***MC***
impact on marine ecosystem functioning or integrity results. **EPO 10** Undertake the Petroleum Activities Program in a manner that will not seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of a migratory species. **EPO 15** Undertake the Petroleum Activities Program in a manner that prevents a substantial adverse effect on a population of fish, marine mammals, marine reptiles, or the spatial distribution of a population. **EPO 23** Undertake the Petroleum Activities Program in a manner that will prevent a substantial adverse effect on a population of marine mammals or the spatial distribution of the population. **EPO 25** Undertake the Petroleum Activities Program in a manner which prevents a vessel strike with protected marine fauna during project activities.	ccetaceans, including the following measures[4]: • Project vessels will not travel greater than 6 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 6 knots. • Vessels will not travel greater than 8 knots within 250 m of a whale shark and not allow the vessel to approach closer than 30 m of a whale shark.	All vessel strike incidents with cetaceans will be reported in the National Ship Strike Database (as outlined in the Conservation Management Plan for the Blue Whale – A Recovery Plan under the EPBC Act 1999, Commonwealth of Australia, 2015a).	Records demonstrate reporting cetacean ship strike incidents to the National Ship Strike Database.
	C 2.1 Comply with in force Sea Dumping Permit (No. SD2019/3982 or amended), which includes the following: • Prior to the commencement of the dumping activities, Contractor must ensure that a check is undertaken, using binoculars from a high observation platform, for marine species within the observation zone. • If any marine species are sighted in the observation zone, must not commence dumping activities until either 10 minutes after	**PS 2.1.3** Compliance of marine species observations set out in in force Sea Dumping Permit (No. SD2019/3982 or amended)	**MC 2.1.3** Records of sighting and locations of marine fauna in the vessels' daily logbook, including any corrective actions taken

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

Environmental Performance Outcomes, Standards and Measurement Criteria			
EPO	***Adopted Control(s)***	***EPS***	***MC***
	the last marine species is observed in the observation zone, or the vessel has moved to another area of the disposal site where it can maintain a minimum distance of 300 metres between the vessel and any marine species.		
	C14.2 During daylight hours, trained vessel crew onboard the TSHD will visually assess marine megafauna and the following observation and exclusion zones will be adhered to during dredging and spoil disposal: • Whales: observation zone 300 m; exclusion zone 100 m • Dolphins: observation zone 150 m (except for material disposal operations where the observation zone is 300m); exclusion zone 50 m • Dugongs: observation zone 150 m (except for material disposal operations where the observation zone is 300m); exclusion zone 50 m • Turtles: observation zone 100 m (except for material disposal operations where the observation zone is 300m); exclusion zone 50 m.	**PS 14.2** Compliance with defined observation and exclusion zones for TSHD operations during daylight hours (excluding transit).	**MC 14.2.1** Records of sighting and locations of marine fauna in the vessels' daily logbook, including any corrective actions taken
	C 14.3 For vessel operations in excess of six knots in the humpback whale migratory BIA between 1 August and 31 October (inclusive), trained vessel crew as MFO to monitor for whales from a high observation platform on the vessel using binoculars by day and thermal imaging	**PS 14.3** For vessel operations in the humpback whale migratory BIA between 1 August and 31 October (inclusive) vessel speed not exceeded six knots within 300 m from a whale and vessel not approach closer than 100 m from a whale.	**MC 14.3.1** Records of MFO training for key vessel crew Records of sighting and locations of marine fauna in the vessels' daily logbook, including any corrective actions taken

Environmental Performance Outcomes, Standards and Measurement Criteria			
EPO	***Adopted Control(s)***	***EPS***	***MC***
	equipment at night or in periods of low visibility. Vessels must not: • travel faster than six knots within 300 m of a whale • approach closer than 100 m from a whale. If a whale(s) shows any sign of being disturbed inside the distances specified, the vessel will immediately withdraw from the whale(s) at a constant speed of less than six knots.		
	C 14.4 At completion of dredge run (i.e. fill of hopper), stop dredge pumps as soon as practicable after the TSHD drag head is lifted from the seafloor.	**PS 14.4** At completion of dredge run (i.e. fill of hopper) dredge pumps have been stopped as soon as practicable after the TSHD drag head is lifted from the seafloor.	**MC 14.4.1** Dredge logs shows timing of pump cessation
	C 14.5 Installation of turtle deflection chains in front of the TSHD drag head.	**PS 14.5** TSHD drag head has turtle deflection chains installed.	**MC 14.5.1** Records show that TSHD drag head has turtle deflection chains installed.
	C 6.2 See **Section 6.6.6**	**PS 6.2** See **Section 6.6.6**	**MC 6.2.1** See **Section 6.6.6**
	C 6.3 See **Section 6.6.6**	**PS 6.3** See **Section 6.6.6**	
	C 6.4 See **Section 6.6.6**	**PS 6.4** See **Section 6.6.6**	

6.7.8 Physical Presence (Unplanned) – Accidental Introduction and Establishment of Invasive Marine Species

Scarborough OPP – Relevant Impact Assessment Section		
Section 7.2.4 – Physical Presence (Unplanned): IMS		
Context		
Relevant Activities Vessel Operations – **Section 3.7** ROV Operations – **Section 3.8.3**	**Existing Environment** Marine Regional Characteristics – **Section 4.2** Physical Environment – **Section 4.4** Habitats and Biological Communities – **Section 4.5**	**Stakeholder consultation** Consultation – **Section 5** No stakeholder concerns have been raised with respect to seabed disturbance due to physical presence of the Petroleum Activities Program or potentially impacted receptors.

Impact/Risk Evaluation Summary

Source of Impact/Risk	*Environmental Value Potentially Impacted*							*Evaluation*						
	Soil and Groundwater	Marine Sediment	Water Quality	Air Quality (inc. odour)	Ecosystems / Habitat	Species	Socio-economic	Decision Type	Impact/Consequence	Likelihood	Current Risk Rating	ALARP Tools	Acceptability	Outcome
Introduction of invasive marine species (IMS) within the Operational Area					✓	✓	✓	A	D	0	L	LCS GP PJ	Broadly Acceptable	EPO 6,26

Description of Source of Impact/Risk

Vessel Operations

During the Petroleum Activities Program, vessels will be transiting to and from the Operational Area, and may mobilise from an Australian port or directly from international waters. Project vessels include dredging, installation and construction vessels, and other support vessels (refer to **Section 3.9.2** and **3.9.3**).

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.), although commercial vessels typically maintain anti-fouling coatings to reduce the build-up of fouling organisms. IMS could be present as biofouling on immersible equipment (survey equipment, ROV, TSHD drag head etc.) and could be translocated to the Operational Area and transferred directly to the seafloor or subsea structures where they could establish. Organisms can also be drawn into ballast tanks during onboarding of ballast water as cargo is loaded or to balance vessels under load.

Cross contamination between vessels can also occur (e.g. IMS translocated between project vessels) during times when vessels need to be alongside each other.

Detailed Impact Assessment

Assessment of Potential Impacts

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.

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).

Epifauna and Infauna, Coral, Seagrass and Macroalgae

Epifauna, infauna and benthic habitats are susceptible to impacts from IMS due to the risk of changes to the ecosystem dynamics such as competition for resources and predation. 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), 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.

The deeper offshore open waters of the Operational Area are not conducive to the settlement and establishment of IMS. The Trunkline Project Area and Offshore Borrow Ground Project Area in shallower waters (30 – 40 m) present a slightly increased risk of IMS establishment, however, IMS require hard substrate/features on the seabed to attach to, none of which is present within the Operational Area. Therefore the risk of establishment, whilst credible, is remote given the distance to hard substrates around islands and shoals, to the Borrow Ground. In addition shallower waters represent a very small area of the overall Operational Area.

Industry, Shipping, and Defence

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. Given the low likelihood of IMS translocation to, and colonisation within the Operational Area, project activities are unlikely to result in establishment of IMS, and as such not adversely affect other marine user activities in the region.

Summary

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**-**24**.

Table 6-24: Credibility, consequence and likelihood of introducing IMS

IMS Introduction Location	Credibility of Introduction	Consequence of Introduction	Likelihood
Introduced to Operational Area and establishment on the seafloor	**Credible** There is potential for IMS to be introduced and established in the shallower waters of the Trunkline Project Area and Borrow Ground.	**Environment (D)** The deeper offshore open waters of the Operational Area are not conducive to the settlement and establishment of IMS. The Trunkline Project Area and Offshore Borrow Ground Project Area in shallower waters (30 – 40 m) present a slightly increased risk of IMS establishment, however, IMS require hard substrate/features on the seabed to attach to, none of which is present within the Operational Area. Therefore the risk of establishment, whilst credible, is remote given the distance to hard	**Remote (0)** In the deeper areas of the Operational Area establishment of IMS is unlikely to occur on the seabed due to the lack of light or suitable habitat and the areas distance from shorelines and/or critical habitat. The risk is slightly greater in the shallower waters of the Trunkline Project Area and Offshore Borrow Ground Project Area, nearer the State waters boundary;

		substrates around islands and shoals, to the Borrow Ground.	however, the seabed remains featureless and not conducive to the settlement and establishment of IMS.
Introduced to Operational Area and establishment on a vessel.	**Credible** There is potential for the transfer of marine pests between vessels within the Operational Area.	**Reputation – E** If IMS were to establish on a vessel this could potentially impact the vessel operationally through the fouling of intakes, result in translocation of an IMS into the Operational Area and, depending on the species, potentially transfer of an IMS to other vessels, which would likely result in the quarantine of the vessel until eradication could occur (through cleaning and treatment of infected areas), which would be costly to perform. Such introduction would be expected to have minor impact to Woodside's reputation, particularly with Woodside's contractors, and would likely have a reputational impact on future proposals.	**Remote (0)** Interactions between vessels will be limited during the Petroleum Activities Program. 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 environments is also considered remote.
Transfer between vessels and 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 Petroleum Activities Program. The transfer of a marine pest between vessels was considered remote, given the offshore open ocean environment (i.e. transfer pathway discussed above). For a marine pest to then establish into a mature spawning population on the vessel (which would have been through Woodside's IMS process) and then transfer to another environment is not considered credible (i.e. beyond the Woodside risk matrix).		

Cumulative Impacts

Cumulative impacts are described in Section 8 of the Scarborough OPP (SA0006AF0000002, rev 5). No cumulative impacts have been identified as a result of the introduction of IMS.

Summary of Assessment Outcomes

Receptor	Impact	Receptor Sensitivity	Consequence	Likelihood	Risk Rating
Epifauna and infauna	Change in ecosystem dynamics	Low value habitat (homogenous)	Negligible (F)	Remote	Low
Industry, shipping and defence	Changes to the functions, interests or activities of other users	Medium value	Slight (E)	Remote	Low

Overall Risk Consequence: The overall risk consequence/risk rating for the introduction of IMS is Low based on a Slight consequence to the most sensitive receptors (other marine users). The risk consequence /risk ratings for individual receptors are consistent with the levels rated in the Scarborough OPP.

Demonstration of ALARP				
Control Considered	***Control Feasibility (F) and Cost/Sacrifice (CS)***	***Benefit in Impact/Risk Reduction***	***Proportionality***	***Control Adopted***
Legislation, Codes and Standards				
Project vessels will manage their ballast water using one of the approved ballast water management options, as specified in the Australian Ballast Water Management Requirements.	F: Yes. CS: Minimal cost. Standard practice.	Reduces the likelihood of transfer of marine pests between 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 15.1**
Good Practice				
Woodside's IMS risk assessment process[5] will be applied to project vessels and immersible equipment undertaking the Petroleum Activities Program. Assessment will consider these risk factors: For vessels: • vessel 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 are 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	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 transfer of marine pests between project vessels and immersible equipment within the Operational Area is reduced. No change in consequence would occur.	Benefits outweigh cost/sacrifice.	Yes **C 15.2**

[5] 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).

Demonstration of ALARP				
Control Considered	***Control Feasibility (F) and Cost/Sacrifice (CS)***	***Benefit in Impact/Risk Reduction***	***Proportionality***	***Control Adopted***
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 the treatment of 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.	F: No. Given that vessels must be used to implement the Petroleum Activities Project, there is no feasible means to eliminate the source of risk. CS: Loss of the project.	Not assessed, control not feasible.	Not assessed, control not feasible.	No
Professional Judgement – Substitute				
Source project vessels based in Australia only.	F: Potentially. Limiting activities to only use local vessels could potentially pose a significant risk in terms of time and duration of sourcing a vessel, as well as the ability of the	Sourcing vessels from within Australian will reduce the likelihood of IMS from outside Australian waters, however, it does not reduce the likelihood of introduction of	Disproportionate. Sourcing vessels from Australian waters may result in a reduction in the likelihood of IMS introduction to the Operational Area;	No

Demonstration of ALARP				
Control Considered	***Control Feasibility (F) and Cost/Sacrifice (CS)***	***Benefit in Impact/Risk Reduction***	***Proportionality***	***Control Adopted***
	local vessels to perform the required tasks. For example, there are limited TSHD vessels based in Australian waters. While the Petroleum Activities Program will attempt to source vessels locally it is not always possible. Availability cannot always be guaranteed when considered competing Oil and Gas activities in the region. In addition, sourcing Australian based vessels only will cause increases in cost due to pressures of vessel availability. CS: Significant cost and schedule impacts due to restrictions of vessel hire opportunities.	species native to Australia but alien to the Operational Area and NWMR, or of IMS that have established elsewhere in Australia. The consequence is unchanged.	however, the potential cost of implementing this control is grossly disproportionate to the minor environmental gain (or reducing an already remote likelihood of IMS introduction) potentially achieved by using only Australian based vessels, consequently this risk is considered not reasonably practicable.	
IMS inspection of all project vessels.	F: Yes. Approach to inspect vessels could be a feasible option. 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 marine pests through biofouling, while targeting its efforts to 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 to be implement achieve an ALARP position.	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 2.3.3**), Woodside considers the adopted controls appropriate to manage the risks and consequences of the introduction of IMS. 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 Criteria and Assessment
The Petroleum Activities Program meets the acceptability criteria (**Section 2.3.5**)*:* • Overall risk consequence/risk ratings for individual receptors are consistent with the levels rated in the Scarborough OPP. • EPOs and controls in the Scarborough OPP that are relevant to an unplanned introduction of IMS have been adopted. • There are no changes to internal/external context specific to this risk from the Scarborough OPP, including issues raised during stakeholder consultation.
Acceptability Statement: The impact assessment has determined that the accidental introduction and establishment of IMS represents a low current risk rating and is unlikely to result in a risk consequence greater than Minor. The adopted controls are considered consistent with industry legislation, codes and standards. Further opportunities to reduce the impacts have been investigated above. The potential risks and consequences are considered acceptable if the adopted controls are implemented. Therefore, Woodside considers the adopted controls appropriate to manage the risks and consequences of an accidental introduction of IMS to a level that is broadly acceptable.

Environmental Performance Outcomes, Standards and Measurement Criteria			
EPO	***Adopted Control(s)***	***EPS***	***MC***
EPO 6 Undertake the Petroleum Activities Program in a manner that will not modify, destroy, fragment, isolate or disturb an important or substantial area of habitat such that an adverse impact on marine ecosystem functioning or integrity results. **EPO 26** Undertake the Petroleum Activities Program in a manner which prevents a known or potential pest species (IMS) becoming established.	**C 15.1** 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 15.1** Prevent the translocation of IMS within the vessel's ballast water from high risk locations to the Operational Area.	**MC 15.1.1** Ballast Water Records System maintained by vessels which verifies compliance against Australian Ballast Water Management Requirements.
	C 15.2 Woodside's IMS risk assessment process[6] will be applied to project vessels and immersible equipment (ROVs) undertaking the Petroleum Activities Program. Assessment will consider these risk factors: For vessels: • vessel type • recent IMS inspection and cleaning history, including for internal niches	**PS 15.2** Before entering the Operational Area or IMS management area[7], project vessels, immersible equipment and AUVs are determined to be low risk[8] of introducing IMS of concern, and maintain this low risk status to mobilisation.	**MC 15.2.1** Records of IMS risk assessments maintained for all project vessels and immersible equipment entering the Operational Area or IMS management area to undertake the Petroleum Activities Program.

[6] 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).
[7] IMS management area is based on current legal framework and includes all nearshore waters around Australia, extending from the lowest astronomical tide mark to 12 nm from land (including Australian territorial islands). The IMS management area also includes all waters within 12 nm from the 50 m depth contour outside the 12 nm boundary (i.e. submerged reefs and atolls).
[8] 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.

Environmental Performance Outcomes, Standards and Measurement Criteria			
EPO	***Adopted Control(s)***	***EPS***	***MC***
	• out-of-water period before mobilisation • age and suitability of antifouling coating at mobilisation date • internal treatment systems and history origin and proposed are 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 the treatment of internal systems, IMS inspections or cleaning) will be implemented to minimise the likelihood of IMS being introduced.		

6.8 Recovery Plan and Threat Abatement Plan Assessment

As described in Section 2.5, 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 described the assessment the Woodside has taken to demonstrate that the Petroleum Activities Program is not inconsistent with any relevant recovery plans of 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 – a Recovery Plan in the Environment Protection and Biodiversity Conservation Act 1999, 2015 – 2025 (Commonwealth of Australia, 2015a).
- Recovery Plan for the Grey Nurse Shark (*Carcharias taurus*) 2014 (Commonwealth of Australia, 2014b).
- Sawfishes and River Sharks Multispecies Recovery Plan (Commonwealth of Australia, 2015c).
- 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 6-25 list 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 clearly inconsistent with that action or not. The results of this assessment against relevant actions are presented in **Table 6-26** to **Table 6-30.**

Table 6-25: Identification of applicability of recovery plan and threat abatement plan objectives and action areas

EPBC Act Part 13 Statutory Instrument	Applicable to:		
	Government	***Licence / 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		

EPBC Act Part 13 Statutory Instrument	Applicable to:		
	Government	***Licence / Titleholder***	***Petroleum Activities Program***
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			
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			
The conservation status of blue whale populations is assessed using efficient and robust methodology	Y		
The spatial and temporal distribution, identification of BIAs, and population structure of blue whales in Australian waters is described	Y	Y	Y
Current levels of legal and management protection for blue whales are maintained or improved and an appropriate adaptive management regime is in place	Y		
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		

EPBC Act Part 13 Statutory Instrument	Applicable to:		
	Government	***Licence / Titleholder***	***Petroleum Activities Program***
B.3: Describing spatial and temporal distribution and defining biologically important habitat	Y	Y	Y
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: • 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	Y	Y	

EPBC Act Part 13 Statutory Instrument	Applicable to:		
	Government	***Licence / Titleholder***	***Petroleum Activities Program***
Specific Objectives			
1. Reduce and where possible, eliminate adverse impacts of commercial fishing on sawfish and river sharks 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 impacts of illegal, unregulated and unreported fishing (IUU) on sawfish and river shark species.	Y		
5. Reduce and, where possible, eliminate adverse impacts on 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 marine 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			
Contribute to long-term prevention of the incidence of marine debris	Y	Y	
Understand the scale of impacts from marine plastic and microplastic on key species, ecological communities and locations	Y	Y	Y
Remove existing marine debris	Y		
Monitor the quantities, origins, types and hazardous chemical contaminants of marine debris, and assess the effectiveness of management arrangements for reducing marine debris	Y		
Increase public understanding of the causes and impacts of harmful marine debris, including microplastic and hazardous chemical contaminants, to bring about behaviour change	Y		

Table 6-26: 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 and H-WA – no relevant actions	Refer **Section 6.7.5** **Not inconsistent assessment**: The assessment of accidental release of solid hazardous and non-hazardous wastes has considered the potential risks to marine turtles.	**EPO 22** **C 7.1, 12.1, 11.3, 12.2** **EPS 7.1, 12.1, 11.3, 12.2**
	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 6.7.2, 6.7.3 and 6.7.4** **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 7.15**. Detailed oil spill preparedness and response performance outcomes, standards and measurement criteria for the Petroleum Activities Program are present in **Appendix D.**
		Action: Routine discharges from project vessels and infrastructure installation are managed such that marine turtles are not adversely affected by changes in water quality. Priority actions at stock level: • G-NWS – as above • LH-WA, F-Pil – as above • H-WA – no relevant actions	Refer **Section 6.7.3, 6.7.4** **Not inconsistent assessment:** The assessment of routine discharges of chemicals, deck drainage, treated sewage, putrescible wastes and grey water has considered the potential risks to marine turtles. Individuals transiting the localised area may come into contact with routine discharges, however these are sporadic and in small	**EPO 3** **C7.1, 7.2, 7.3, 7.4** **EPS 7.1, 7.2, 7.3, 7.4**

Part 13 Statutory Instrument	Relevant Action Areas/Objectives	Relevant Actions	Evaluation	EPO, Controls and PS
			quantities, and are unlikely to pose a significant risk.	
	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 • F-Pil and H-WA – manage artificial light from onshore and offshore sources to ensure biologically important behaviours of nesting adults and emerging/dispersing hatchlings can continue	Refer **Section 6.6.4** **Not inconsistent assessment**: The assessment of light emissions has considered the potential impacts to marine 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 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.	**EPO 12** **C 4.1, 4.2, 4.3, 4.4, 4.5** **EPS 4.1, 4.2, 4.3, 4.4, 4.5**
	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 and H-WA – no relevant actions	**Not inconsistent assessment**: Woodside contributes to Action Area B1 via its support of the Ningaloo Turtle Program[9].	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	Refer **Section 6.6.6** **Not inconsistent assessment**: The assessment of acoustic emissions has considered the potential impacts to flatback, hawksbill and green turtles. Vessel and seismic acoustic emissions could cause localised and short-term behavioural	**EPO 11** **C 6.1, 6.8, 6.10** **EPS 6.1, 6.8, 6.10**

9 http://www.ningalooturtles.org.au/media_reports.html

Part 13 Statutory Instrument	Relevant Action Areas/Objectives	Relevant Actions	Evaluation	EPO, Controls and PS
		biology and extrapolate findings from the NWS stock to other stocks • LH-WA, F-Pil – no relevant actions • H-WA – investigate mixed stock genetics at foraging grounds	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.	
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.				

Table 6-27: 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 BIAs will be managed such that any blue whale continues to use the area without injury, and is not displaced from a foraging area	Refer **Section 6.6.6** **Not inconsistent assessment**: The assessment of acoustic emissions has considered the potential impacts to pygmy blue whales.	**EPO 11, 15** **C 6.1, 6.2, 6.3, 6.4, 6.5, 6.6, 6.7, 6.8, 6.9, 6.10** **EPS 6.1, 6.2, 6.3, 6.4, 6.5, 6.6, 6.7, 6.8, 6.9, 6.10**
	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 6.7.7** **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 overlaps with the northern migration, individuals may deviate slightly from migratory route, but will continue on their migration to possible breeding grounds in Indonesian waters. Vessel collisions with pygmy blue whales are highly unlikely to occur, given the very slow vessel speeds and presence of MFOs.	**EPO 25** **C 14.1, 14.2, 14.3, 6.3, 6.4, 6.5, 6.6, 6.7, 6.8, 6.9, 6.10** **EPS 14.1, 14.2, 14.3, 6.3, 6.4, 6.5, 6.6, 6.7, 6.8, 6.9, 6.10**

Part 13 Statutory Instrument	Relevant Action Areas/Objectives	Relevant Actions	Evaluation	EPO, Controls and PS
	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 BIAs	**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[10]).	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.				

Table 6-28: 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 **Section 6.7.8** **Not inconsistent assessment**: The assessment of accidental release of solid hazardous and non-hazardous wastes has considered the potential risks to grey nurse sharks.	**EPO 26** **C 15.1, 15.2** **EPS 15.1, 15.2**
			Refer **Sections 6.7.2** and **6.7.3** **Not inconsistent assessment**: The species was identified to potentially occur within the EMBA and therefore the assessment of accidental release of hydrocarbons has considered the potential risks to grey nurse sharks.	Refer **Section 7.15** Detailed oil spill preparedness and response performance outcomes, standards and measurement criteria for the Petroleum Activities Program are

[10] 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

Part 13 Statutory Instrument	Relevant Action Areas/Objectives	Relevant Actions	Evaluation	EPO, Controls and PS
				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.				

Table 6-29: 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 on 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 **Section Sections 6.6** and **6.7** **Not inconsistent assessment**: The species was identified to potentially occur within the EMBA and therefore the assessment of accidental release of hydrocarbons has considered the potential risks to sawfish and river shark.	Refer **Section 7.15** 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 noting the linkages with the Threat Abatement Plan for the Impact of Marine Debris on Vertebrate Marine Life.	**Action 6a**: Assess the impacts of marine debris including ghost nets, fishing gear and plastics on sawfish and river shark species	Refer **Section 6.7.5** **Not inconsistent assessment:** The assessment of accidental release of solid hazardous and non-hazardous wastes has considered the potential risks to sawfish and river sharks.	**EPO 22** **C 7.1, 12.1, 11.3, 12.2** **EPS 7.1, 12.1, 11.3, 12.2**

Part 13 Statutory Instrument	Relevant Action Areas/Objectives	Relevant Actions	Evaluation	EPO, Controls and PS
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.				

Table 6-30: Assessment against relevant Marine Debris Threat Abatement Plan

Part 13 Statutory Instrument	Relevant Action Areas/Objectives	Relevant Actions	Evaluation	EPO, Controls and PS
Marine Debris TAP	**Objective 1:** Contribute to long-term prevention of marine debris.	**Action 1.02**: Limit the amount of single use plastic material lost to the environment in Australia.	Refer **Section 6.7.5** **Not inconsistent assessment**: The assessment of accidental release of solid hazardous and non-hazardous wastes has considered the potential risks to vertebrate wildlife.	**EPO 22** **C 7.1, 12.1, 11.3, 12.2** **EPS 7.1, 12.1, 11.3, 12.2**
Assessment Summary The Marine Debris Threat Abatement 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.				

7. IMPLEMENTATION STRATEGY

7.1 Overview

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

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

7.2 Systems, Practice and Procedures

All operational activities are planned and carried out in accordance with relevant legislation and standards, management measures (i.e. controls) 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 be subject to change during the statutory duration of this EP and is managed through a Change Register and update process.

7.2.1 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.

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 (UK) and the Netherlands. It applies the requirements of 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 chemical management.

All chemical substances 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 7-1**):

- Hazard Quotient (HQ) Colour Band: Gold, Silver, White, Blue, Orange or Purple (listed in order of increasing environmental hazard).
- 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.

<table>
<tr><td>Hazard Quotient Colour Band</td><td>Gold</td><td>Silver</td><td>White</td><td>Blue</td><td>Orange</td><td>Purple</td></tr>
<tr><td>OCNS Grouping</td><td>E</td><td>D</td><td>C</td><td colspan="2">B</td><td>A</td></tr>
<tr><td></td><td colspan="3">Lowest Hazard →</td><td colspan="3">Highest Hazard</td></tr>
</table>

Figure 7-1 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 following types of chemicals require further assessment to understand the environmental impacts of discharge into the marine environment:
  - chemicals with no OCNS ranking
  - chemicals with an HQ band of White, Blue, Orange or Purple or an OCNS ranking of A, B or C
  - chemicals with an OCNS product or substitution warning.

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

Ecotoxicity

Chemical ecotoxicity is assessed using the criteria used by CEFAS to group chemicals based on ecotoxicity results (**Table 7-1**). 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 7-1: 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	>100-1000	>1000
Results for sediment toxicity data (ppm)	<10	>10-100	>100-1000	>1000-10,000	>10,000

Note: Aquatic toxicity refers to the Skeletonema costatum 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 >60% biodegradation in 28 days to an OSPAR harmonised offshore chemical notification format (HOCNF) accepted ready biodegradation protocol
- inherently biodegradable: results >20% and <60% to an OSPAR HOCNF accepted ready biodegradation protocol or result of >20% by OSPAR accepted inherent biodegradation study
- not biodegradable: results from OSPAR HOCNF accepted biodegradation protocol or inherent biodegradation protocol are <20%, or half-life values derived from aquatic simulation test indicate persistence.

Chemicals with >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: Log Pow <3, or BCF ≤100 and molecular weight is ≥700
- bioaccumulative: Log Pow ≥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, the following options are considered:

- 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.

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.

Decision

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

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 7-2**. Roles and responsibilities for oil spill preparation and response are outlined in **Appendix D** and the *Woodside Oil Pollution Emergency Arrangements (Australia)*.

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.

Table 7-2: Roles and responsibilities

Title (role)	Environmental Responsibilities
Office-based Personnel	
Woodside Project Manager (or delegate/s)	• Monitor and manage the activity so it is undertaken as per the relevant standards and commitments in this EP. • Notify the Woodside Environment Adviser of any scope changes in a timely manner. • Liaise with regulatory authorities as required. • Review this EP as necessary and manage change requests. • Ensure all project and support vessel crew members complete an HSE induction. • Verify that contractors meet environmental related contractual obligations. • Confirm environmental incident reporting meets regulatory requirements (as outlined in this EP) and Woodside's Health, Safety and Environment Reporting and Investigation Procedure. • Monitor and close out corrective actions identified during environmental monitoring or audits.
Woodside Environmental Adviser	• Verify relevant Environmental Approvals for the activities exist prior to commencing activity. • Track compliance with performance outcomes and performance standards as per the requirements of this EP. • Prepare environmental component of relevant Induction Package. • Assist with the review, investigation and reporting of environmental incidents. • Ensure environmental monitoring and inspections/audits are undertaken as per the requirements of this EP. • Liaise with relevant regulatory authorities as required. • Assist in preparation of external regulatory reports required, in line with environmental approval requirements and Woodside incident reporting procedures. • Monitor and close out corrective actions (Campaign Action Register (CAR)) identified during environmental monitoring or audits. • Provide advice to relevant Woodside personnel and contractors to assist them to understand their environment responsibilities. • Liaise with primary installation vessel 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. • Ongoing liaison and notification as required as per **Section 7.13**.

Title (role)	Environmental Responsibilities
Woodside Marine Assurance Superintendent	• Conducts 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 CICC Duty Manager	On receiving notification of an incident, the Woodside CICC Duty Manager shall: • establish and take control of the IMT and establish an appropriate command structure for the incident • assess 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 setting 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.
Vessel-based Personnel	
Vessel Master (all vessel types)	• 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 undertake the work they have been assigned. • Verify SOPEP drills are conducted as per the vessel's schedule. • Ensure the vessel Emergency Response Team (ERT) has been given sufficient training to implement the SOPEP. • Ensure any environmental incidents or breaches of relevant Environmental Performance Outcomes or performance standards detailed in this EP, are reported immediately to the Woodside Site Representative. • Ensure corrective actions for incidents or breaches are developed, communicated to the Woodside Site Representative, and tracked to close out in a timely manner. Close out of actions is communicated to the Woodside Site Representative.
Vessel Logistics Coordinators	• Ensure waste is managed on the relevant vessels and sent to shore as per the relevant Waste Management Plan.
Vessel HSE Advisers*	• Support the Woodside Site Representative to ensure the controls detailed in this EP relevant to offshore activities are implemented on the vessels and help collect and record evidence of implementation (other controls are implemented and evidence collected onshore). • Support the Woodside Site Representative to ensure the EPOs are met and the PSs detailed in this EP are implemented on the vessels

Title (role)	Environmental Responsibilities
	• Support the Woodside Site Representative 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.
Offshore Construction Manager*	• Confirm that activities are undertaken 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 undertake 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.
Woodside Site Representative (WSR) / Resident Engineer*	• Ensure activities are undertaken as detailed in this EP. • Ensure the management measures made in this EP are implemented on the vessel • Ensure environmental incidents or breaches of objectives, standards or criteria outlined in this EP, are reported as per the Woodside Corporate Event Notification Matrix • Verify HSE improvement actions identified during the project are implemented where practicable • Ensure periodic environmental inspections are completed.

*Apply to PV and construction vessel(s) – other vessels in the PAP will have different levels of crewing. Where named roles are not present onboard, responsibilities will fall to the PV or construction vessel personnel who will manage the other vessels accordingly.

7.4 Training and Competency

7.4.1 Overview

Woodside as part of its contracting process undertakes assessments of a proposed Contractor's environmental management system to determine the level of compliance with the standard AS/NZS ISO 14001. This assessment is undertaken 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 during inductions is required for all vessel personnel, detailing awareness and compliance with the project vessel 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 and Environment 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 MC.
- Incident reporting.

7.4.3 Activities Program Specific Environmental Awareness

Before petroleum activities begin, a pre-activity meeting will be held on-board the project vessels with all relevant personnel. The pre-activity meeting provides an opportunity to reiterate specific environmental sensitivities or commitments associated with the activity. Attendance lists are recorded and retained. Relevant sections of the pre-activity meeting will also be communicated through to the support vessel personnel. Attendance lists are recorded and retained.

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

7.4.4 Marine Fauna Observation Training

The Marine Fauna Observer (MFO) role may be completed by vessel crew who are appropriately trained prior to the activity commencing. This training will include as a minimum:

- An overview of the potential impacts to protected marine fauna.
- An overview of species that may be present during activities.
- The role and responsibilities of MFOs.

- The management procedures in place to protect marine fauna.
- The observation and reporting requirements (Section 7.13).

Records will be maintained by the vessel operator(s) as evidence of the vessel crew who have completed the MFO training. The vessel operator will also maintain records of fauna sightings and reporting made throughout the activities.

7.4.5 Management of Training Requirements

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

7.5 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 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 recording and submitting 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
- Environmental discharge reports that record volumes of planned and unplanned discharges, to ocean and atmosphere.
- Internal auditing and assurance program as described in **Section 7.6**.

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 7.6**.

7.5.2 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.

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.

7.6 Tiered Monitoring and Management Framework

The tiered monitoring and management framework (TMMF) is a proactive and adaptive framework informed by water quality to manage the dredging activities such that impacts to benthic communities and habitats (BCH) are not realised through its implementation, based on sponge communities as the most sensitive ecological receptor in Commonwealth waters. The TMMF aims to manage TSHD trenching and spoil disposal, and borrow ground dredging and backfill activities, and associated water quality to a level where impacts are not predicted to occur to BCH. An overview of the TMMF is provided below with the details to be included in a standalone management and monitoring plan.

7.6.1 Tiered trigger levels and process

An overview of the management triggers for the marine park boundary monitoring site is provided in **Table 7-3.** The management triggers have been derived from the same dataset and literature as the modelling thresholds, however have been applied conservatively, with the Tier 3 management trigger aligned with the ZoMI threshold (i.e. reversible impacts). In Commonwealth waters, the thresholds are for sponges and filter feeders, as corals, seagrasses and macroalgae are not known to form significant communities in the zone. Filter feeder-sponge thresholds and associated management triggers have been adapted from Pineda et al. (2017).

Table 7-3: Tiered management trigger levels

Trigger	Monitoring site	Averaging Period	Trigger (NTU)	DLI (mol/d)
Tier 1	Marine Park Boundary	24 hours	Summer: 1.8 Winter: 0.75	-
Tier 2	Marine Park Boundary	26 days	11.25	0.9
Tier 3	Marine Park Boundary	28 days	11.25	0.9

The assessment of water quality data against the tiered management triggers comprises two key aspects:

- The exceedance of a numeric value for turbidity and daily light integral (DLI) over a defined averaging time period
- A Project attributability assessment to determine if trenching and spoil disposal or borrow ground dredging and backfill activities can reasonably be expected to have contributed to or caused the exceedance.

Both parts of the assessment are required before it can be determined that an exceedance of a management trigger has occurred. For example, if the numeric value for water quality is exceeded but the attributability assessment indicates that the exceedance is not attributable to Project activities then the determination is the trigger level has not been exceeded.

When a tiered management trigger is exceeded, the initial response is to investigate the cause of the exceedance and whether or not the detected change can be reasonably attributed to dredging (trenching or borrow ground), spoil disposal or backfill activities, rather than a result of an anomalous reading or a natural event. This approach ensures that adaptive management actions are targeted to improving water quality and that the program can be completed effectively within the proposed timeframes.

There are two key steps for assessing project attributability; assessment of data reliability and evaluation of multiple lines of evidence, including but not limited to weather and oceanographic conditions, site specific and regional water quality data, nature of recent dredging activities and experimental evidence. The attributability assessment will be documented and appropriately conservative based on the evidence available.

In the event that an exceedance is found to be attributable to trenching and spoil disposal or borrow ground dredging and backfill activities, the appropriate actions will be identified and initiated as per the TMMF illustrated in **Figure 7-2.** For a Tier 2 and Tier 3 management trigger exceedances, this includes the identification and execution of appropriate responsive or contingency management actions respectively.

Responsive management actions will be implemented when a Project attributable Tier 2 exceedance has occurred. There are a range of responsive management actions that are considered practical to reduce the mass of sediment released during trenching and spoil disposal or borrow ground dredging and backfill activities, such as reduce overflow, move location etc.(Netzband et al., 2009). While, contingency management actions will be applied when a Project attributable Tier 3 exceedance has occurred. Contingency management actions are those known to markedly reduce the loss of fines sediment released during dredging activities (e.g. no overflow, move location, tidally restrict operations, cease dredging (Netzband et al., 2009)).

Water quality will continue to be monitored during a Tier 2 and Tier 3 Project attributable trigger exceedance to assess whether the adopted management actions have been effective in improving water quality. Responsive and contingency management action/s can only cease (return to normal operations) once turbidity returns below the Tier 2 trigger or once superseded by implementing more effective management action/s.

An overview of the management framework is presented in **Figure 7-2.**

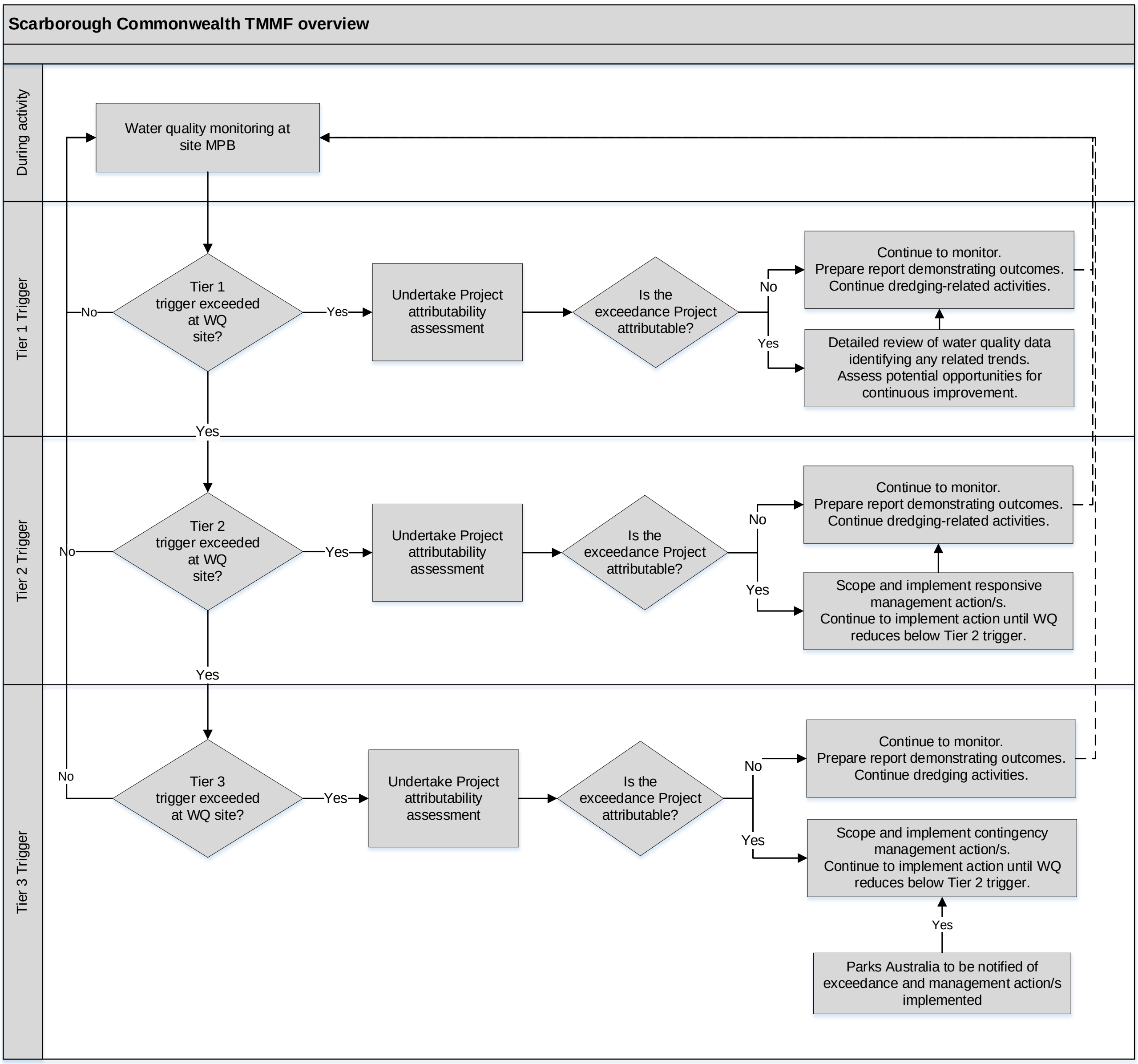


Figure 7-2: Tiered monitoring and management framework overview

7.6.2 Water quality monitoring

The Marine Park Boundary monitoring site has been selected to ensure that water quality levels within the Dampier Marine Park are managed to a level at which impacts are not predicted to occur to sponge and filter feeder communities (**Table 7-3**). This site has been selected given the marine park values, however the management of water quality to the levels outlined in **Table 7-3** is considered to be conservative a given that benthic communities where the ZoI overlaps the Marine Park are sparse.

The ZoI is only predicted to intersect these locations when dredging at the offshore borrow ground for backfill activities and thus monitoring will be completed during these activities only.

Table 7-4: Water quality monitoring site locations

Water quality site	Easting	Northing
MPB (marine park boundary)	489287	7755317

The water quality monitoring program relies on near real-time measurements of turbidity and photosynthetic active radiation (PAR), the latter as a measure of daily light integral (DLI). Turbidity and light will be measured approximately one meter above the seabed at all sites at a depth that is most reflective of the conditions which receptors are experiencing. Theses instrument will be programmed to record every 30 minutes to provide an early insight into the deterioration of water quality (natural or project related). Turbidity and light data will be telemetered at appropriate frequencies to a host website where water quality data can be compared against the tiered trigger levels.

Water quality instruments will be calibrated and maintained in accordance with the manufacturer's recommendations. It is anticipated that during the campaign, there is likely to be some loss of data due to equipment failure or fouling. To address this, there will be a maintenance schedule with all instruments systematically retrieved, downloaded, cleaned and redeployed/replaced (as necessary) to maintain the data quality and ensure a high percentage of data collection.

Routine servicing of the water quality monitoring instruments is expected to occur every four to eight weeks to ensure good data quality and minimise the risk of data loss, although this period may be reduced or extended based on the data recorded. An adequate number of replacement instruments will be available where required.

The analysis of water quality parameters will use best practice summary statistics and analysis techniques based on outcomes from the WAMSI dredging science node studies, where applicable (e.g., Jones et al. 2015b, Jones et al. 2016).

7.7 Management of Marine Fauna

During daylight hours, trained vessel crew onboard the dredge, or rock placement vessel will visually assess marine fauna and the following observation and exclusion zones will be adhered to during operation of the dredge and rock placement vessels and during disposal of material at the spoil grounds:

- whales: observation zone 300 m; exclusion zone 100 m
- dolphins: observation zone 150 m (except for spoil disposal operations where the observation zone is 300m); exclusion zone 50 m
- dugongs: observation zone 150 m (except for spoil disposal operations where the observation zone is 300m); exclusion zone 50 m
- turtles and seasnakes: observation zone 100 m (except for spoil disposal operations where the observation zone is 300 m); exclusion zone 50 m.

If marine fauna is observed at the spoil grounds, the vessel must move 300 m or more away from the marine fauna before commencing dumping operations.

During transit to and from the spoil grounds or borrow ground, vessels (including the TSHD and split hopper barges) will operate in accordance with EPBC Regulations 2000 – Part 8 Division 8.1.

Figure 7-3 outlines the marine fauna management procedure during dredging, rock placement, backfill and pipelay operations.

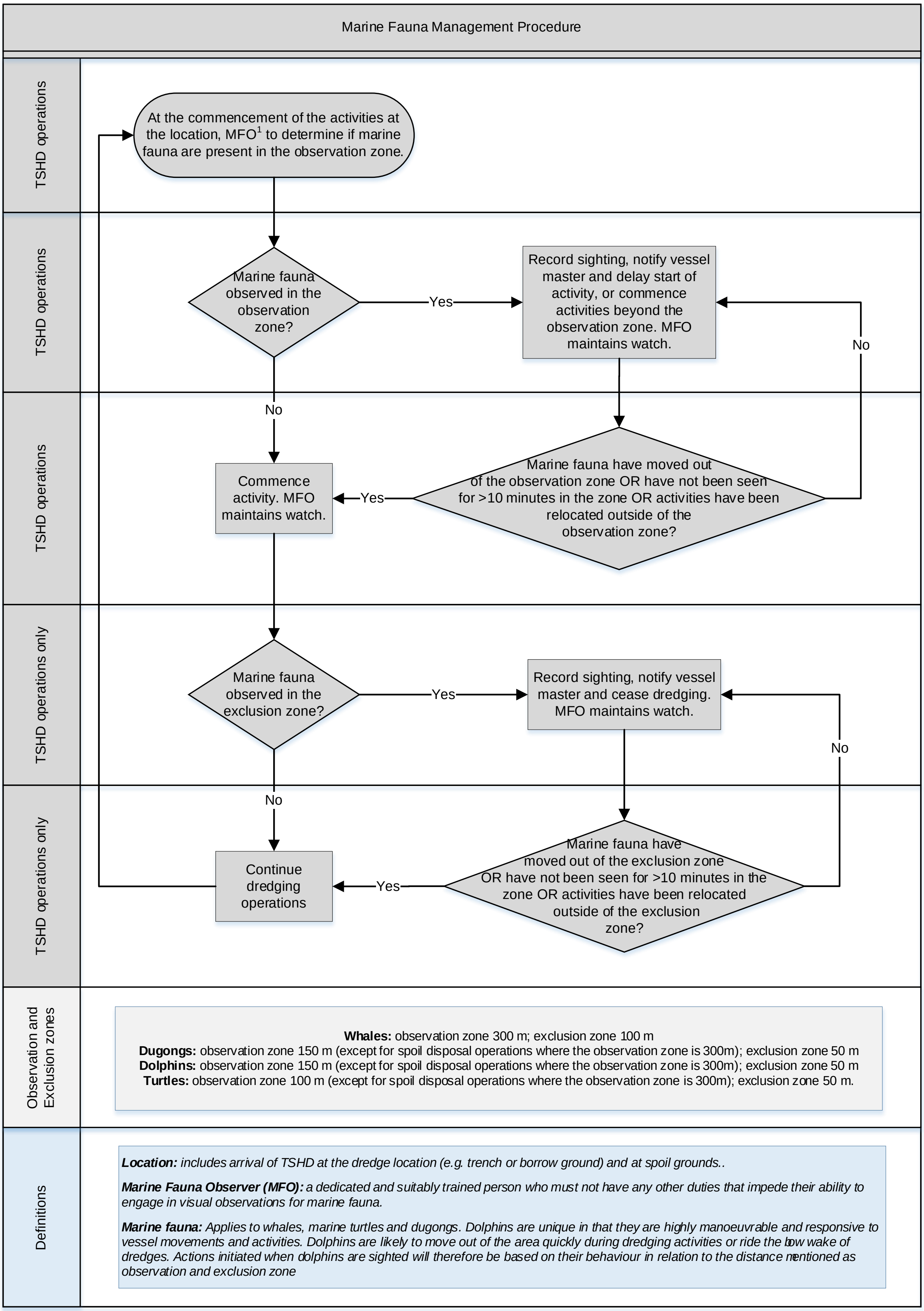


Figure 7-3: Marine fauna management procedure during TSHD operations

7.8 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.

7.8.1 Subsea Installation 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 installation vessels associated with the seabed intervention and trunkline installation activities will be audited by Woodside. Support or transport vessels will be assessed on a risk-based approach, but will be audited via the contractor's process.
- At least one operational compliance audit relevant to applicable EP commitments will be conducted by a Woodside Environment Adviser for the seabed intervention and trunkline installation activities. 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**, and collection of evidence for MC are used to assess EPOs and standards.

As part of Woodside's 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 7.9**.

7.8.2 Marine Assurance

All vessels are subject to the Marine Offshore Assurance process and review of the Offshore Vessel Inspection Database (OVID). All required audits and inspections will assess compliance with the laws of the international shipping industry, which includes safety and environmental management requirements, and maritime legislation including International Convention for the Prevention of

Pollution from Ships 1973, as modified by the Protocol of 1978 (MARPOL) and other International Maritime Organization (IMO) standards.

Woodside's marine assurance is managed by the Marine Assurance Team of the Logistics Function in 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.

Woodside's Marine Offshore Assurance process is mandatory for all vessels (other than Tankers and Floating Production Storage and Offloading vessels) that are chartered directly by or on behalf of Woodside, 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:

- Safety Management System Assessment.
- Dynamic Positioning (DP) System Verification.
- Vessel Inspections.
- 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:

1. Woodside Marine Vessel Inspection
2. OCIMF OVID Inspection
3. IMCA CMID Inspection
4. 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 to complete an vessel inspection and/or OVMSA Verification Review are performed (i.e. short term vessel hire), the Marine Assurance Specialist Offshore may approve the use of an alternate means of inspection, known as a risk assessment.

7.8.3 Risk Assessment

Woodside conducts a risk assessment of vessels where either an OVMSA Verification Review and/or vessel 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 Marine Vessel Risk Assessment will be conducted by the Marine Assurance Specialist, where the vessel meets the short term hire prerequisites.

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.

7.9 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 6**). Detailed investigations are completed for all categories A, B, C and high potential environmental incidents.

7.10 Review

7.10.1 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. seabed intervention and trunkline installation), managers review environmental performance regularly, including through quarterly HSE review meetings.

Woodside Environment Team will perform six-monthly reviews of the effectiveness of the implementation strategy and associated tools. This will involve reviewing the:

- Seabed intervention and trunkline installation activities environment KPIs (leading and lagging).
- Tools and systems to monitor environmental performance (detailed in **Section 7.5**)
- Lessons learned about implementation tools and throughout each campaign.

Reviews of oil spill arrangements and testing are performed in accordance with **Section 7.15**.

7.10.2 Learning and Knowledge Sharing

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

- Event investigations.
- Event bulletins.
- After action review conducted, including review of environmental incidents as relevant.
- Ongoing communication with project vessel operators.
- Formal and informal industry benchmarking.
- Cross asset learnings.
- Engineering and technical authorities discipline communications and sharing.

7.10.3 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 7.11**).

7.11 Management of Change and Revision

7.11.1 EP Management of Change

Management of changes are managed in accordance with Woodside's Environmental Approval Requirements Australia Commonwealth Guideline. 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 2.3**) 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.

7.11.2 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 7.11.1**). 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.

7.12 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.

7.13 Reporting

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

7.13.1 Routine Reporting (Internal)

7.13.1.1 Daily Progress Reports and Meetings

Daily reports for activities are prepared and issued to key support personnel and stakeholders, by relevant managers. The report provides performance information about seabed intervention and trunkline installation 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.

7.13.1.2 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.

7.13.1.3 Performance Reporting

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

- 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.

7.13.2 Routine Reporting (External)

7.13.2.1 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.

7.13.2.2 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 7-5**.

Table 7-5: Routine external reporting requirements

Report	Recipient	Frequency	Content
Monthly Recordable Incident Reports (**Appendix D)**	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.
Notification to Director of National Parks	DNP	Approximately 10 days prior to entering the Montebello Marine Park and at the conclusion of activities within the Australian Marine Park.	Notifications can be made to marineparks@environment.gov.au

7.13.2.3 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.

7.13.3 Incident Reporting (Internal)

The process for reporting environmental incidents is described in **Section 7.13.4** 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.

7.13.4 Incident Reporting (External) – Reportable and Recordable

7.13.4.1 Reportable Incidents

7.13.4.1.1 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'.

A reportable incident for the Petroleum Activities Program is:

- an incident that has caused or 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 **Appendix A** and **Section 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 environmental risk assessment identified one risk with a potential consequence level of C+ for environment. The highest consequence identified in the risk assessment was a *Loss of hydrocarbons to marine environment due to a vessel collision*, with a consequence level of B for environment.

Any such incidents (with a Consequence Level of Moderate (C)) 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.

7.13.4.1.2 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 D**) 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.

7.13.4.2 Recordable Incidents

7.13.4.2.1 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’.

7.13.4.2.2 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 (**Appendix D**) 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.
- 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.

7.14 Other External Incident Reporting Requirements

In addition to the notification and reporting of environmental incidents defined under the Environment Regulations and Woodside requirements, **Table 7-6** describes the incident reporting requirements that also apply in the Operational Area.

Table 7-6: 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
Any emergency, accident, hazardous situation, near miss and/or any pollution incident in or with potential to impact PPA waters	Vessel Master	PPA	All incidents and near misses on a vessel must be reported to PPA Dampier Vessel Traffic Services (VTS) immediately It is a PPA requirement that the any incident or near miss shall prepare a report and send	PPA Dampier Vessel Traffic Services	VHF 11 (Port vessel working channel) VHF 16 (Port vessel emergency channel) (08) 9159 6556 (landline telephone)

Event	Responsibility	Notifiable party	Notification requirements	Contact	Contact detail
			to PPA (dampier.vts@pilbaraports.com.au) within 48 hours		0428 888 800 (24 hour emergency mobile telephone) dampier.vts@pilbaraports.com.au

The following pollution activities should also be reported to AMSA via RCC Australia by the Vessel Master are:

- 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 Scarborough Seabed Intervention and Trunkline Installation Oil Pollution First Strike Plan (**Appendix D**).

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.

7.15 Emergency Preparedness and Response

7.15.1 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 7-7**.

Table 7-7: 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 D**) • 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 D**)

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 7.15.5** 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)

7.15.2 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 (**Table 7-8**). 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 7-8: Minimum levels of competency for key IMT positions

IMT Position	Minimum Competency
Corporate Incident Coordination 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 and 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.* 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).

7.15.3 Emergency Response Preparation

The 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 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 vessel activity, the ERP will be a bridging document to the contracted vessels 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 vessel and ensures roles and responsibilities between the contracted vessel 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:

- 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 project vessels will have on-board equipment for responding to emergencies including medical equipment, fire-fighting equipment and oil spill response equipment.

7.15.4 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 Emergency Arrangements (Australia) document, supported by the Oil Pollution First Strike Plan

(**Appendix D**) which provides 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 provides immediate actions required to commence a response (**Appendix D**).

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**.

7.15.5 Emergency and Spills Response

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

7.15.5.1 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.

7.15.5.2 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.

7.15.5.3 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 ICC may also be activated as required to manage the operational incident response.

7.15.6 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 7-9**. 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, where appropriate.

Table 7-9: Testing of response capability

Response Category	Scope	Response Testing Frequency	Response Testing Objective
Level 1 Response	Exercises are project-/ activity-specific [1]	At least one Level 1 First Strike drill must be conducted during an activity. For campaigns with an operational duration of greater than one month this will occur within the first two weeks of commencing the activity and then at least every 6 month hire period thereafter.	• Comprehensive exercises test elements of the *Seabed Intervention and Trunkline Installation* Oil Pollution First Strike Plan **(Appendix D**). • Emergency drills are scheduled to test other aspects of the Emergency Response Plan.
Level 2 Response	Exercises are vessel specific [2]	Level 2 Emergency Management exercises are relevant to activities with an operational duration of one month or greater. At least one Emergency Management exercise per vessel per campaign must be conducted within the first month of commencing the activity and then at every 6 month hire period thereafter, where applicable based on duration.	• Testing both the facility IMT response and/or that of the CICC following handover of incident control.
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.

[1] Please note that for this EP, Level 1 drills will be applicable to PV, SWLB, TSHD and RIV
[2] Please note that for this EP, Level 2 exercises will be applicable to PV only

7.15.7 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:

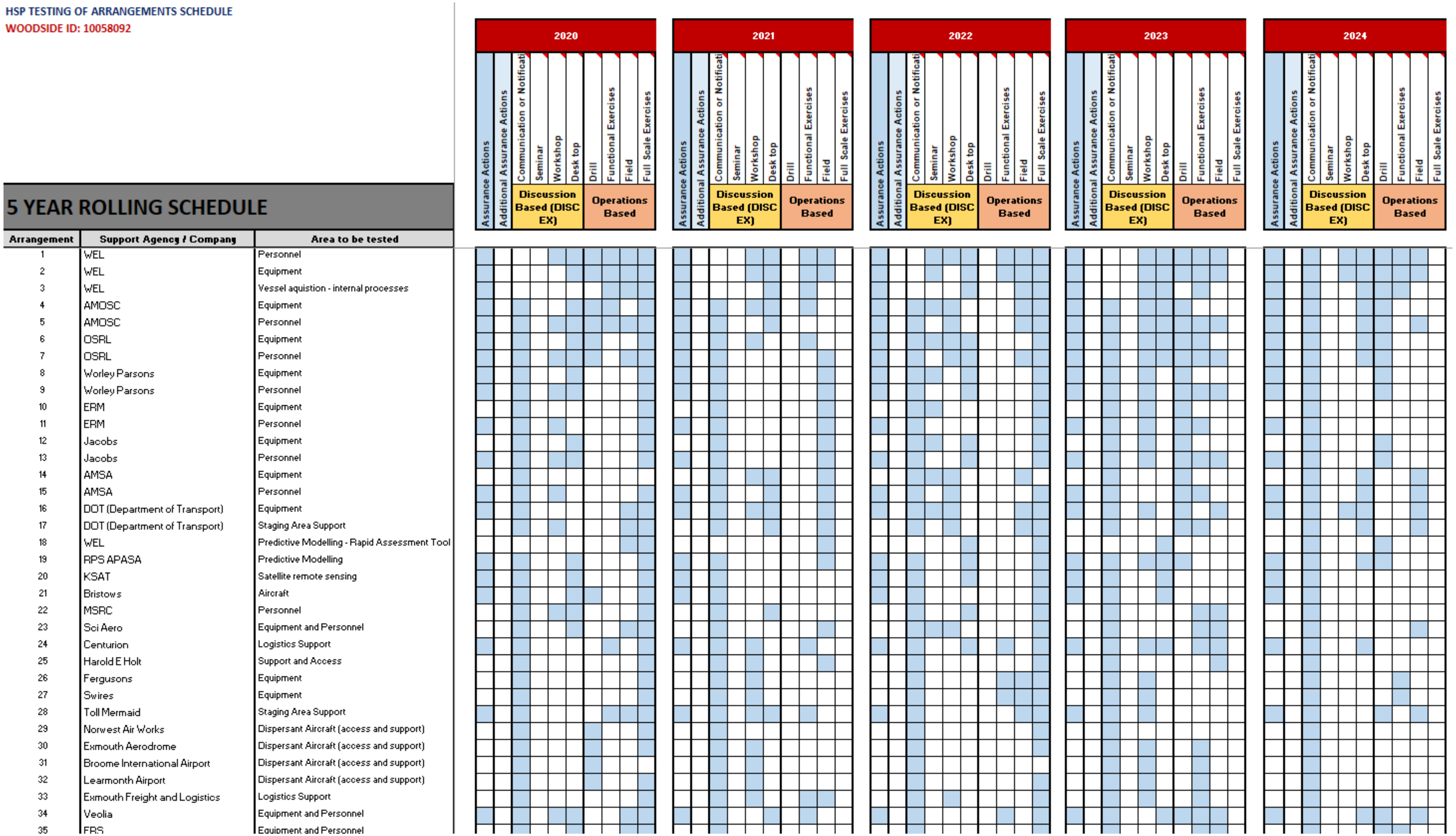
- Ensure relevant responders, contractors and key personnel understand and practise their assigned roles and responsibilities.
- Test response arrangements and actions to validate response plans.
- Ensure lessons learned are incorporated into Woodside's processes and procedures and improvements are made where required.

If new response arrangements are introduced, or existing arrangements significantly amended, additional testing is undertaken accordingly. 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 7-9**, up to eight formal exercises are planned annually, across Woodside, to specifically test arrangements for responding to a hydrocarbon spill to the marine environment.

7.15.7.1 Testing of Arrangements Schedule

Woodside's Testing of Arrangements Schedule (**Figure 7-4**) 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 7-4** shows a condensed snapshot of Woodside's 5-year rolling Testing of Arrangements 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	ERS	Equipment and Personnel

Figure 7-4: 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)

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 7-4** 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 7-4**).

7.15.7.2 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 7.15.7.1**).
- 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).

7.15.7.3 Cyclone and Dangerous Weather Preparation

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

The project vessels will receive daily forecasts from the 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. GLOSSARY AND ABBREVIATIONS

9.1 Glossary

Term	Meaning
(the) Regulator	The Government Agency (State or Commonwealth) that is the decision maker for approvals and performs ongoing regulation of the approval once granted
3D seismic data	A set of numerous closely-spaced seismic lines that provide a high spatially sampled measure of subsurface reflectivity and 3D image
Acceptability	The EP must demonstrate that the environmental impacts and risks of an activity will be of an acceptable level as per Regulation 10A(c).
ALARP	A legal term in Australian safety legislation, it is taken here to mean that all contributory elements and stakeholders have been considered by assessment of costs and benefits, and which identifies a preferred course of action
API (gravity)	A measure of how heavy or light a petroleum liquid is compared to water
Australian Standard	An Australian Standard that provides criteria and guidance on design, materials, fabrication, installation, testing, commissioning, operation, maintenance, re-qualification and abandonment
Ballast	Extra weight taken on to increase a ship's stability to prevent rolling and pitching. Most ships use seawater as ballast. Empty tank space is filled with inert (non-combustible) gas to prevent the possibility of fire or explosion.
Bathymetry	Related to water depth, a bathymetry map shows the depth of water at a given location on the map.
Benthos/Benthic	Relating to the seabed and includes organisms living in or on sediments/rocks on the seabed
Biodiversity	Relates to the level of biological diversity of the environment. The EPBC Act defines biodiversity as "the variability among living organisms from all sources (including terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part) and includes: (a) diversity within species and between species; and (b) diversity of ecosystems".
Biota	The animal and plant life of a particular region, habitat or geological period
Cetacean	Whale and dolphin species
Consequence	The worst-case credible outcome associated with the selected event, assuming some controls (prevention and mitigation) have failed. Where more than one impact applies (e.g. environmental and legal/compliance), the consequence level for the highest severity impact is selected.
Coral	Anthozoa that are characterised by stone-like, horny or leathery skeletons (external or internal). The skeletons of these animals are also called coral.
Coral Reef	A wave-resistant structure resulting from skeletal deposition and cementation of hermatypic corals, calcareous algae, and other calcium carbonate-secreting organisms
Crustacean	A large and variable group of mostly aquatic invertebrates that have a hard external skeleton (shell), segmented bodies, with a pair of often very modified appendages on each segment, and two pairs of antennae (e.g. crabs, crayfish, shrimps, wood lice, water fleas and barnacles)
Cyclone	A rapidly-rotating storm system characterised by a low-pressure centre, strong winds, and a spiral arrangement of thunderstorms that produce heavy rain
Datum	A reference location or elevation that is used as a starting point for subsequent measurements

Term	Meaning
dB	Decibel, a measure of the overall noise level of sound across the audible spectrum with a frequency weighting (that is, 'A' weighting) to compensate for the varying sensitivity of the human ear to sound at different frequencies
dB re 1 μPa^2	Measure of underwater noise, in terms of sound pressure. Because the dB is a relative measure rather than an absolute measure, it must be referenced to a standard 'reference intensity', in this case 1 micro Pascal (1 mPa), which is the standard reference that is used. The dB is also measured over a specified frequency, which is usually either a one Hertz bandwidth (expressed as dB re 1 mPa2/Hz), or over a broadband that has not been filtered. Where a frequency is not specified, it can be assumed that the measurement is a broadband measurement.
dB re 1 μPa^2.s	Normal unit for sound exposure level
Demersal	Living close to the floor of the sea (typically of fish)
Drill casing	Tubing that is set inside the drilled well to protect and support the well stream
Drilling fluids	The main functions of drilling fluids include providing hydrostatic pressure to prevent formation fluids from entering the well bore, keeping the drill bit cool and clean during drilling, performing drilled cement, and suspending the drilled cement while drilling is paused and when the drilling assembly is brought in and out of the hole. The drilling fluid used for a particular job is selected to avoid formation damage and to limit corrosion. The three main categories of drilling fluids are water-based muds (which can be dispersed and non-dispersed), non-aqueous muds, usually called oil-based mud, and gaseous drilling fluid, in which a wide range of gases can be used.
DRIMS	Woodside's internal document management system
Dynamic positioning	In reference to a marine vessel that uses satellite navigation and radio transponders in conjunction with thrusters to maintain its position
EC_{50}	The concentration of a drug, antibody or toxicant which induces a response halfway between the baseline and maximum after a specified exposure time
Echinoderms	Any of numerous radially symmetrical marine invertebrates of the phylum Echinodermata, which includes the starfish, sea urchins and sea cucumbers, that have an internal calcareous skeleton and are often covered with spines
Endemic	A species that is native to or confined to a certain region
Environment	The surroundings in which an organisation operates, including air, water, land, natural resources, flora, fauna, humans and their interrelations (Source: ISO 14001)
EP	Prepared in accordance with the *OPGGS (Environment) Regulations 2009*, which must be assessed and accepted by the Designated Authority (NOPSEMA) before any petroleum-related activity can be performed
Environment Regulations	OPGGS (Environment) Regulation 2009
Environmental approval	The action of approving something, which has the potential to have an adverse impact on the environment. Environmental impact assessment is generally required before environmental approval is granted.
Environmental Hazard	The characteristic of an activity or event that could potentially cause damage, harm or adverse effects on the environment
Environmental impact	Any change to the environment, whether adverse or beneficial, wholly or partially resulting from an organisation's activities, products or services (Source: HB 203:2006).
Environmental impact assessment	An orderly and systematic process for evaluating a proposal or scheme (including its alternatives), and its effects on the environment, and mitigation and management of those effects (Source: Western Australian *Environmental Impact Assessment Administrative Procedures 2010*)

Term	Meaning
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999*. Commonwealth legislation designed to promote the conservation of biodiversity and protection of the environment.
Epifauna	Benthic animals that live on the surface of a substrate
Fauna	Collectively, the animal life of a particular region
Flora	Collectively, the plant life of a particular region
IC_{50}	A measure of the effectiveness of a compound in inhibiting biological or biochemical function
Infauna	Aquatic animals that live in the substrate of a body of water, especially in a soft sea bottom
ISO 14001	ISO 14001 is an international standard that specifies a process (called an EMS) for controlling and improving a company's environmental performance. An EMS provides a framework for managing environmental responsibilities so they become more efficient and more integrated into overall business operations.
Jig Fishing	Fishing with a jig, which is a type of fishing lure. A jig consists of a lead sinker with a hook moulded into it and usually covered by a soft body to attract fish.
LC_{50}	The concentration of a substance that is lethal to 50% of the population exposed to it for a specified time
Likelihood	The description that best fits the chance of the selected consequence actually occurring, assuming reasonable effectiveness of the prevention and mitigation controls
MARPOL (73/78)	The International Convention for the Prevention of Pollution from Ships 1973, as modified by the Protocol of 1978. MARPOL 73/78 is one of the most important international marine environmental conventions. It was designed to minimise pollution of the seas, including dumping, oil and exhaust pollution. Its stated objective is to preserve the marine environment through the complete elimination of pollution by oil and other harmful substances and the minimisation of accidental discharge of such substances.
Meteorology	The study of the physics, chemistry and dynamics of the earth's atmosphere, including the related effects at the air–earth boundary over both land and the oceans
Mitigation	Management measures that minimise and manage undesirable consequences
NOHSC (1008:2004)	National Occupational Health and Safety Commission – Approved Criteria for Classifying Hazardous Substances
Oligotrophic	Low in plant nutrients and having a large amount of dissolved oxygen throughout
pH	Measure of the acidity or basicity of an aqueous solution
Protected Species	Threatened, vulnerable or endangered species that are protected from extinction by preventive measures. Often governed by special Federal or State laws.
Putrescible	Refers to food scraps and other organic waste associated with food preparation that will be subject to decay and rot (putrefaction)
Risk	The combination of the consequences of an event and its associated likelihood. For guidance, see Environmental Guidance on Application of Risk Management Procedure.
Stereo-BRUVS	Stereo-baited remote underwater video systems
Sessile	Organism that is fixed in one place; immobile
Syngnathids	Family of fish which includes the seahorses, the pipefish, and the weedy and leafy sea dragons
Teleost	A fish belonging to the Teleostei or Teleostomi, a large group of fish with bony skeletons, including most common fish. The teleosts are distinct from the cartilaginous fish such as sharks, rays, and skates.

Term	Meaning
Thermocline	A temperature gradient in a thermally stratified body of water
Zooplankton	Plankton consisting of small animals and the immature stages of larger animals

9.2 Abbreviations

Abbreviation	Meaning
µm	Micrometer
AHC	Active Heave Compensated
AHS	Australian Hydrographic Service
AIIMS	Australasian Inter-service Incident Management Systems
AIS	Automatic Identification System
ALARP	As Low As Reasonably Practicable
AMOSC	Australian Marine Oil Spill Centre
AMPS	Australian Marine Parks
AMSA	Australian Maritime Safety Authority
API	American Petroleum Institute
ATSB	Australian Transport Safety Bureau
AusSAR	Australian Search and Rescue
AUV	Autonomous Underwater Vehicle
BbI/MMscf	Barrels per million Standard Cubic Feet of gas
BCF	Bioconcentration Factor
BCH	Benthic Communities and Habitat
BHP	BHP Billiton Petroleum (North West Shelf) Pty Ltd
BIA	Biologically Important Area
BoM	Bureau of Meteorology
BTEX	Benzene, toluene, ethylbenzene and xylenes
°C	Degrees Celsius
(C)	Consequence level of moderate
C	Control
CAES	Catch and Effort System
CCP	Cyclone Contingency Plan
CEFAS	Centre for Environment, Fisheries and Aquaculture Science
CH_4	Methane
CICC	Corporate Incident Coordinate Centre
CM	Control Measure
CMT	Crisis Management Team
CO	Carbon monoxide
CO_2	Carbon dioxide

Abbreviation	Meaning
cP	Centipoises
CS	Cost/Sacrifice
CSIRO	Commonwealth Scientific and Industrial Research Organisation
Cth	Commonwealth
CWP	Central Western Province
CWST	Central Western Shelf Transition
(D)	Consequence level Minor
DAA	Department of Aboriginal Affairs
DAWE	Department of Agriculture, Water and the Environment
DEWHA	Department of Environment, Water, Heritage and the Arts
DGPS	Differential GPS
DMA	Dead Man Anchor
DMIRS	Department of the Responsible State Minister
DMP	Department of Mines and Petroleum
DNP	Director of National Parks
DP	Dynamically Positioned
DPIRD	Department of Primary Industries and Regional Development
DSDMP	Dynamic System Development Method
(E)	Slight Risk Consequence
E and P	Exploration and Production
Environment Regulations	Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2009 (Cth)
EMBA	Environment that May Be Affected
EMS	Environmental Management System
ENVID	Environmental hazard Identification
EP	Environment Plan
EPA	Environmental Protection Authority
EPBC Act	Environmental Protection and Biodiversity Conservation Act 1999
EPO's	Environmental Performance Outcomes
EPS	Environmental Performance Standards
ERP	Emergency Response Plan
ESD	Ecologically Sustainable Development
(F)	Negligible risk consequence
F	Control Feasibility
FCGT	Flood, Clean, Gauge and Hydrotest
FEED	Front End Engineering Design
F-Pil	Flatback-Pilbara (marine turtle genetic stock)
FPU	Floating Production Unit
FPV	Fall Pipe Vessel

Abbreviation	Meaning
G-NWS	Green-North West Shelf (marine turtle genetic stock)
GDA	Geocentric Datum of Australia
GHG	Greenhouse gas
g/m^2	Grams per square metre
HFCs	Hydrofluorocarbon
HFO	Heavy fuel oil
HOCNF	Harmonised Offshore Chemical Notification Format
HSE	Health, Safety and Environment
HSPU	Hydrocarbon Spill Preparedness Unit
HQ	Hazard Quotient
H-WA	Hawksbill-Western Australia (marine turtle genetic stock)
IAPP	International Air Pollution Prevention
IC	Incident Controller
ICC	Incident Coordination Centre
ICLDP	Incident Crisis Leadership Development Program
IMCRA	Integrated Marine and Coastal Regionalisation of Australia
IMO	International Marine Organisation
IMS	Invasive Marine Species
IMT	Incident Management Team
IPIECA	International Petroleum Industry Environmental Conservation Association
IS	Implementation Strategy
ISO	International Organization for Standardization
ISPP	International Sewage Pollution Prevention
ITF	Indonesian Throughflow
ITOPF	International Tank Owners Pollution Federation Limited
IUCN	International Union for Conservation of Nature
JSA	Job Safety Assessment
JRCC	Joint Rescue Coordination Centre
KEF	Key Ecological Feature
Kg/m^3	Kilograms per metre cubed
Km	Kilometres
KP	Kilometre Point
KPI	Key Performance Indicator
LBL	Long Baseline
LED	Light emitting diode
LH-WA	Loggerhead-Western Australia (marine turtle genetic stock)
L/km^2	Litres per square Kilometre
MARPOL	International Convention for the Prevention of Pollution from Ships
MBES	Multi Beam Echo Sounders

Abbreviation	Meaning
MCs	Measurement Criteria
MDO	Marine Diesel Oil
MEG	Mono-ethylene Glycol
MFE	Mass Flow Excavator
MFO	Marine Fauna Observers
MGA	Map Grid of Australia
MGO	Magnesium Oxide
MMA-WHA	Marine Management Area - World Heritage Area
MMSI	Maritime Mobile Service Identity
MNES	Matters of National Environmental Significance
MOC	Management of Change
MODU	Mobile Offshore Drilling Unit
MP	Marine Park
MPA	Marine Protected Areas
MSIN	Maritime Safety Information Notifications
MUZ	Multiple Use Zone
N/A	Not Applicable
NDE	Non-destructive examination
NERA	National Energy Resources Australia
NHP	National Heritage Places
NIMS	Non-indigenous Marine Species
N_2O	Nitrous oxide
NOAA	National Oceanic and Atmospheric Administration
NOEC	No-Observed-Effect Concentrations
NOx	Oxides of nitrogen
NOPSEMA	National Offshore Petroleum Safety and Environmental Management Authority
NOPTA	National Offshore Petroleum Title Administrator
NTM	Notice to Mariners
NWMR	North-west Marine Region
NWP	Northwest Province
NWSP	North West Shelf Province
NWS Project	North West Shelf Project
NWSTF	North West Slope Trawl Fishery
NWT	North West Transition
OCNS	Offshore Chemical Notification Scheme
OCV	Offshore Construction Vessel
OILMAP	Oil Spill Prediction Modelling System
OIM	Offshore Installation Manager
OIW	Oil In Water

Abbreviation	Meaning
OPEP	Oil Pollution Emergency Plan
OPGGS	Offshore Petroleum and Greenhouse Gas Storage Act 2006
OPP	Offshore Project Proposal
OSPAR Convention	Oslo and Paris Commission for the Convention for the Protection of the Marine Environment of the North-East Atlantic
OSREC	Oil Spill Response Skills Enhancement Course
OSRO	Oil Spill Response Organisation
OVID	Offshore Vessel Inspection Database
OVSMA	Offshore Vessel Safety Management System Assessment
PBA	Pre-emptive Baseline Areas
PFCs	Perfluorocarbon
pH	Power of hydrogen
PV	Pipelay Vessel
PLET	Pipeline End Termination
PM10	Particulate matter less than 10 microns
PMST	Protected Matters Search Tool
ppm	Parts Per Million
PS	Performance Standards
RCC	Rescue Coordination Centre
RIV	Rock Installation Vessel
RO	Reverse Osmosis
ROV	Remotely Operated Vehicle
SBP	Sub Bottom Profiler
SEEP	Ship Energy Efficiency Management Plan
SF6	Sulphur hexafluoride
SIMAP	Spill Impact Mapping and Analysis Program
SMPEP	Spill Monitoring Programme Execution Plan
SO_2	Sulphur dioxide
SOLAS	Safety of Life at Sea
SOPEP	Ship Oil Pollution Emergency Plan
SSCs	Suspension Sediment Concentrations
SSS	Side Scan Sonar
SWLB	Shallow Water Lay Barge
TAP	Marine Debris Threat Abatement Plan
TSHD	Trailing Suction Hopped Dredge
UK	United Kingdom
US	United States
USBL	Ultra-short baseline
UWA	University of Western Australia

Abbreviation	Meaning
VOCs	Non-methane volatile organic compounds
WAF	Water Accommodated Fractions
WAMSI	Western Australian Marine Science Institution
WCC	Woodside Communication Centre
Woodside	Woodside Energy Ltd
WHA	World Heritage Area
WHP	World Heritage Place
WLS	Woodside Learning Services
WMS	Woodside Management System
ZoI	Zone of Influence
ZoMI	Zone of Moderate Impact
ZoHI	Zone of High Impact

APPENDIX A. WOODSIDE ENVIRONMENT AND RISK MANAGEMENT POLICIES

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

APPROVED

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.

APPROVED

APPENDIX B. RELEVANT REQUIREMENTS

This appendix refers to Commonwealth Legislation related to the project. Western Australian State Legislation relevant to an accidental release of hydrocarbons in WA State waters is outlined in the Julimar Phase 2 Drilling and Subsea Installation Oil Pollution Emergency Plan.

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.

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 - Mobile offshore drilling units* • *Marine order 57 - Helicopter operations* • *Marine order 60 - Floating offshore facilities* • *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.

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 prevention—anti-fouling systems)*	This Act relates to the protection of the sea from the effects of harmful anti-fouling systems. It prohibits the application or reapplication of harmful anti-fouling compounds on Australian ships or foreign ships that are in an Australian shipping facility.

APPENDIX C. EPBC ACT PROTECTED MATTERS SEARCH

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.

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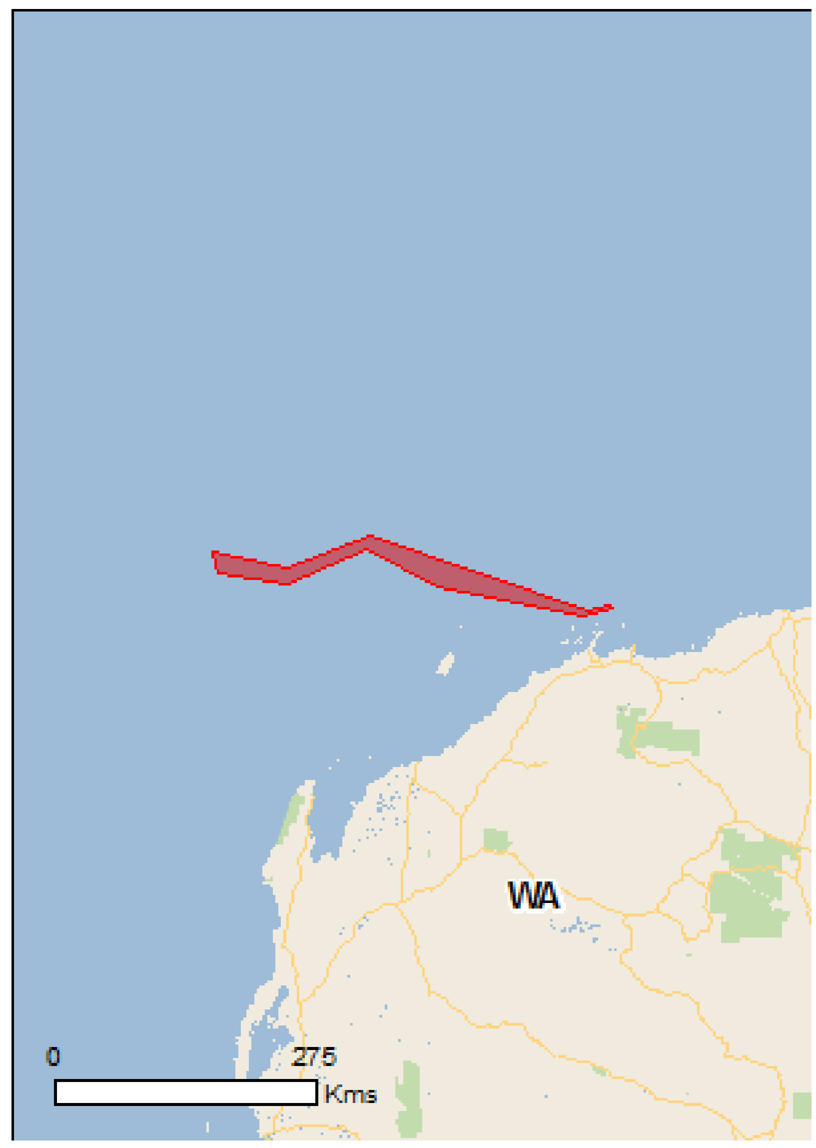

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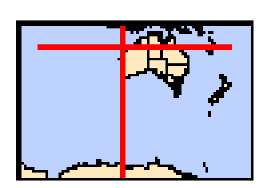

Summary

Matters of National Environmental Significance

This part of the report summarises the matters of national environmental significance that may occur in, or may relate to, the area you nominated. Further information is available in the detail part of the report, which can be accessed by scrolling or following the links below. If you are proposing to undertake an activity that may have a significant impact on one or more matters of national environmental significance then you should consider the Administrative Guidelines on Significance.

World Heritage Properties:	None
National Heritage Places:	None
Wetlands of International Importance:	None
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	1
Listed Threatened Ecological Communities:	None
Listed Threatened Species:	21
Listed Migratory Species:	39

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:	72
Whales and Other Cetaceans:	28
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Australian Marine Parks:	2

Extra Information

This part of the report provides information that may also be relevant to the area you have nominated.

State and Territory Reserves:	None
Regional Forest Agreements:	None
Invasive Species:	None
Nationally Important Wetlands:	None
Key Ecological Features (Marine)	3

Details

Matters of National Environmental Significance

Commonwealth Marine Area [Resource Information]

Approval is required for a proposed activity that is located within the Commonwealth Marine Area which has, will have, or is likely to have a significant impact on the environment. Approval may be required for a proposed action taken outside the Commonwealth Marine Area but which has, may have or is likely to have a significant impact on the environment in the Commonwealth Marine Area. Generally the Commonwealth Marine Area stretches from three nautical miles to two hundred nautical miles from the coast.

Name
EEZ and Territorial Sea

Marine Regions [Resource Information]

If you are planning to undertake action in an area in or close to the Commonwealth Marine Area, and a marine bioregional plan has been prepared for the Commonwealth Marine Area in that area, the marine bioregional plan may inform your decision as to whether to refer your proposed action under the EPBC Act.

Name
North-west

Listed Threatened Species [Resource Information]

Name	Status	Type of Presence
Birds		
Calidris canutus		
Red Knot, Knot [855]	Endangered	Species or species habitat may occur within area
Calidris ferruginea		
Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
Macronectes giganteus		
Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Species or species habitat may occur within area
Numenius madagascariensis		
Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area
Sternula nereis nereis		
Australian Fairy Tern [82950]	Vulnerable	Breeding known to occur within area
Mammals		
Balaenoptera borealis		
Sei Whale [34]	Vulnerable	Species or species habitat likely to occur within area
Balaenoptera musculus		
Blue Whale [36]	Endangered	Migration route known to occur within area
Balaenoptera physalus		
Fin Whale [37]	Vulnerable	Species or species habitat likely to occur within area
Megaptera novaeangliae		
Humpback Whale [38]	Vulnerable	Breeding known to occur within area
Reptiles		

Name	Status	Type of Presence
Aipysurus apraefrontalis Short-nosed Seasnake [1115]	Critically Endangered	Species or species habitat likely 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	Congregation or aggregation known to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Congregation or aggregation 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	Congregation or aggregation 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 likely to occur within area
Carcharodon carcharias White Shark, Great White Shark [64470]	Vulnerable	Species or species habitat may occur within area
Pristis clavata Dwarf Sawfish, Queensland Sawfish [68447]	Vulnerable	Species or species habitat known to occur within area
Pristis zijsron Green Sawfish, Dindagubba, Narrowsnout Sawfish [68442]	Vulnerable	Species or species habitat known to occur within area
Rhincodon typus Whale Shark [66680]	Vulnerable	Foraging, feeding or related behaviour known to occur within area

Listed Migratory Species [Resource Information]

* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.

Name	Threatened	Type of Presence
Migratory Marine Birds		
Anous stolidus Common Noddy [825]		Species or species habitat may occur within area
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely 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
Macronectes giganteus Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Species or species habitat may occur within

Name	Threatened	Type of Presence
		area
Sterna dougallii Roseate Tern [817]		Breeding likely to occur within area
Migratory Marine Species		
Anoxypristis cuspidata Narrow Sawfish, Knifetooth Sawfish [68448]		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 within area
Balaenoptera borealis Sei Whale [34]	Vulnerable	Species or species habitat likely to occur within area
Balaenoptera edeni Bryde's Whale [35]		Species or species habitat likely to occur within area
Balaenoptera musculus Blue Whale [36]	Endangered	Migration route known to occur within area
Balaenoptera physalus Fin Whale [37]	Vulnerable	Species or species habitat likely to occur within area
Carcharhinus longimanus Oceanic Whitetip Shark [84108]		Species or species habitat 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	Congregation or aggregation known to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Congregation or aggregation known to occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Species or species habitat likely to occur within area
Dugong dugon Dugong [28]		Species or species habitat known to occur within area
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	Congregation or aggregation 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 likely to occur within area

Name	Threatened	Type of Presence
Megaptera novaeangliae Humpback Whale [38]	Vulnerable	Breeding known to occur within area
Natator depressus Flatback Turtle [59257]	Vulnerable	Congregation or aggregation known to occur within area
Orcinus orca Killer Whale, Orca [46]		Species or species habitat may occur within area
Physeter macrocephalus Sperm Whale [59]		Species or species habitat may occur within area
Pristis clavata Dwarf Sawfish, Queensland Sawfish [68447]	Vulnerable	Species or species habitat known to occur within area
Pristis zijsron Green Sawfish, Dindagubba, Narrowsnout Sawfish [68442]	Vulnerable	Species or species habitat known to occur within area
Rhincodon typus Whale Shark [66680]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Sousa chinensis Indo-Pacific Humpback Dolphin [50]		Species or species habitat may occur within area
Tursiops aduncus (Arafura/Timor Sea populations) Spotted Bottlenose Dolphin (Arafura/Timor Sea populations) [78900]		Species or species habitat likely to occur within area
Migratory Wetlands Species		
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat may occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat may occur within area
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat may occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat may occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area
Pandion haliaetus Osprey [952]		Species or species habitat 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
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat may occur within area
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat may occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat may occur within area
Calonectris leucomelas Streaked Shearwater [1077]		Species or species habitat likely to occur within area
Fregata ariel Lesser Frigatebird, Least Frigatebird [1012]		Species or species habitat likely to occur within area
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
Sterna dougallii Roseate Tern [817]		Breeding 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

Name	Threatened	Type of Presence
		area
Choeroichthys brachysoma Pacific Short-bodied Pipefish, Short-bodied Pipefish [66194]		Species or species habitat may occur within area
Choeroichthys latispinosus Muiron Island Pipefish [66196]		Species or species habitat may occur within area
Choeroichthys suillus Pig-snouted Pipefish [66198]		Species or species habitat may occur within area
Corythoichthys flavofasciatus Reticulate Pipefish, Yellow-banded Pipefish, Network Pipefish [66200]		Species or species habitat may occur within area
Cosmocampus banneri Roughridge Pipefish [66206]		Species or species habitat may occur within area
Doryrhamphus dactyliophorus Banded Pipefish, Ringed Pipefish [66210]		Species or species habitat may occur within area
Doryrhamphus excisus Bluestripe Pipefish, Indian Blue-stripe Pipefish, Pacific Blue-stripe Pipefish [66211]		Species or species habitat may occur within area
Doryrhamphus janssi Cleaner Pipefish, Janss' Pipefish [66212]		Species or species habitat may occur within area
Doryrhamphus multiannulatus Many-banded Pipefish [66717]		Species or species habitat may occur within area
Doryrhamphus negrosensis Flagtail Pipefish, Masthead Island Pipefish [66213]		Species or species habitat may occur within area
Festucalex scalaris Ladder Pipefish [66216]		Species or species habitat may occur within area
Filicampus tigris Tiger Pipefish [66217]		Species or species habitat may occur within area
Halicampus brocki Brock's Pipefish [66219]		Species or species habitat may occur within area
Halicampus grayi Mud Pipefish, Gray's Pipefish [66221]		Species or species habitat may occur within area
Halicampus nitidus Glittering Pipefish [66224]		Species or species habitat may occur within area
Halicampus spinirostris Spiny-snout Pipefish [66225]		Species or species habitat may occur within area
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

Name	Threatened	Type of Presence
Hippocampus angustus Western Spiny Seahorse, Narrow-bellied Seahorse [66234]		Species or species habitat may occur within area
Hippocampus histrix Spiny Seahorse, Thorny Seahorse [66236]		Species or species habitat may occur within area
Hippocampus kuda Spotted Seahorse, Yellow Seahorse [66237]		Species or species habitat may occur within area
Hippocampus planifrons Flat-face Seahorse [66238]		Species or species habitat may occur within area
Hippocampus spinosissimus Hedgehog Seahorse [66239]		Species or species habitat may occur within area
Hippocampus trimaculatus Three-spot Seahorse, Low-crowned Seahorse, Flat-faced Seahorse [66720]		Species or species habitat may occur within area
Micrognathus micronotopterus Tidepool Pipefish [66255]		Species or species habitat may occur within area
Phoxocampus belcheri Black Rock Pipefish [66719]		Species or species habitat may occur within area
Solegnathus hardwickii Pallid Pipehorse, Hardwick's Pipehorse [66272]		Species or species habitat may occur within area
Solegnathus lettiensis Gunther's Pipehorse, Indonesian Pipefish [66273]		Species or species habitat may occur within area
Solenostomus cyanopterus Robust Ghostpipefish, Blue-finned Ghost Pipefish, [66183]		Species or species habitat may occur within area
Syngnathoides biaculeatus Double-end Pipehorse, Double-ended Pipehorse, Alligator Pipefish [66279]		Species or species habitat may occur within area
Trachyrhamphus bicoarctatus Bentstick Pipefish, Bend Stick Pipefish, Short-tailed Pipefish [66280]		Species or species habitat may occur within area
Trachyrhamphus longirostris Straightstick Pipefish, Long-nosed Pipefish, Straight Stick Pipefish [66281]		Species or species habitat may occur within area
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 apraefrontalis Short-nosed Seasnake [1115]	Critically Endangered	Species or species habitat likely to occur within area
Aipysurus duboisii Dubois' Seasnake [1116]		Species or species habitat may occur within

Name	Threatened	Type of Presence
		area
Aipysurus eydouxii Spine-tailed Seasnake [1117]		Species or species habitat may occur within area
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 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	Congregation or aggregation known to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Congregation or aggregation 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
Emydocephalus annulatus Turtle-headed Seasnake [1125]		Species or species habitat may occur within area
Ephalophis greyi North-western Mangrove Seasnake [1127]		Species or species habitat may occur within area
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	Congregation or aggregation 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

Name	Threatened	Type of Presence
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 bonaerensis Antarctic Minke Whale, Dark-shoulder Minke Whale [67812]		Species or species habitat likely 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 likely to occur within area
Balaenoptera musculus Blue Whale [36]	Endangered	Migration route known to occur within area
Balaenoptera physalus Fin Whale [37]	Vulnerable	Species or species habitat likely to occur within area
Delphinus delphis Common Dolphin, Short-beaked Common Dolphin [60]		Species or species habitat may occur within area
Feresa attenuata Pygmy Killer Whale [61]		Species or species habitat may occur within area
Globicephala macrorhynchus Short-finned Pilot Whale [62]		Species or species habitat may occur within area
Grampus griseus Risso's Dolphin, Grampus [64]		Species or species habitat may occur within area
Kogia breviceps Pygmy Sperm Whale [57]		Species or species habitat may occur within area
Kogia 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

Name	Status	Type of Presence
		area
Peponocephala electra Melon-headed Whale [47]		Species or species habitat may occur within area
Physeter macrocephalus Sperm Whale [59]		Species or species habitat may occur within area
Pseudorca crassidens False Killer Whale [48]		Species or species habitat likely to occur within area
Sousa chinensis Indo-Pacific Humpback Dolphin [50]		Species or species habitat may occur within area
Stenella attenuata Spotted Dolphin, Pantropical Spotted Dolphin [51]		Species or species habitat may occur within area
Stenella coeruleoalba Striped Dolphin, Euphrosyne Dolphin [52]		Species or species habitat may occur within area
Stenella longirostris Long-snouted Spinner Dolphin [29]		Species or species habitat may occur within area
Steno bredanensis Rough-toothed Dolphin [30]		Species or species habitat may occur within area
Tursiops aduncus Indian Ocean Bottlenose Dolphin, Spotted Bottlenose Dolphin [68418]		Species or species habitat likely to occur within area
Tursiops aduncus (Arafura/Timor Sea populations) Spotted Bottlenose Dolphin (Arafura/Timor Sea populations) [78900]		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
Dampier	Habitat Protection Zone (IUCN IV)
Montebello	Multiple Use Zone (IUCN VI)

Extra Information

Key Ecological Features (Marine) [Resource Information]

Key Ecological Features are the parts of the marine ecosystem that are considered to be important for the biodiversity or ecosystem functioning and integrity of the Commonwealth Marine Area.

Name	Region
Ancient coastline at 125 m depth contour	North-west
Continental Slope Demersal Fish Communities	North-west
Exmouth Plateau	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

-20.0736 113.9023,-19.7757 114.6566,-20.0886 115.3037,-20.3542 116.6914,-20.2944 116.9631,-20.2537 116.9275,-20.3039 116.7342,-19.6467 114.6609,-19.9369 113.898,-19.7961 113.1851,-19.9687 113.2331,-20.0736 113.9023

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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EPBC Act Protected Matters Report

This report provides general guidance on matters of national environmental significance and other matters protected by the EPBC Act in the area you have selected.

Information on the coverage of this report and qualifications on data supporting this report are contained in the caveat at the end of the report.

Information is available about Environment Assessments and the EPBC Act including significance guidelines, forms and application process details.

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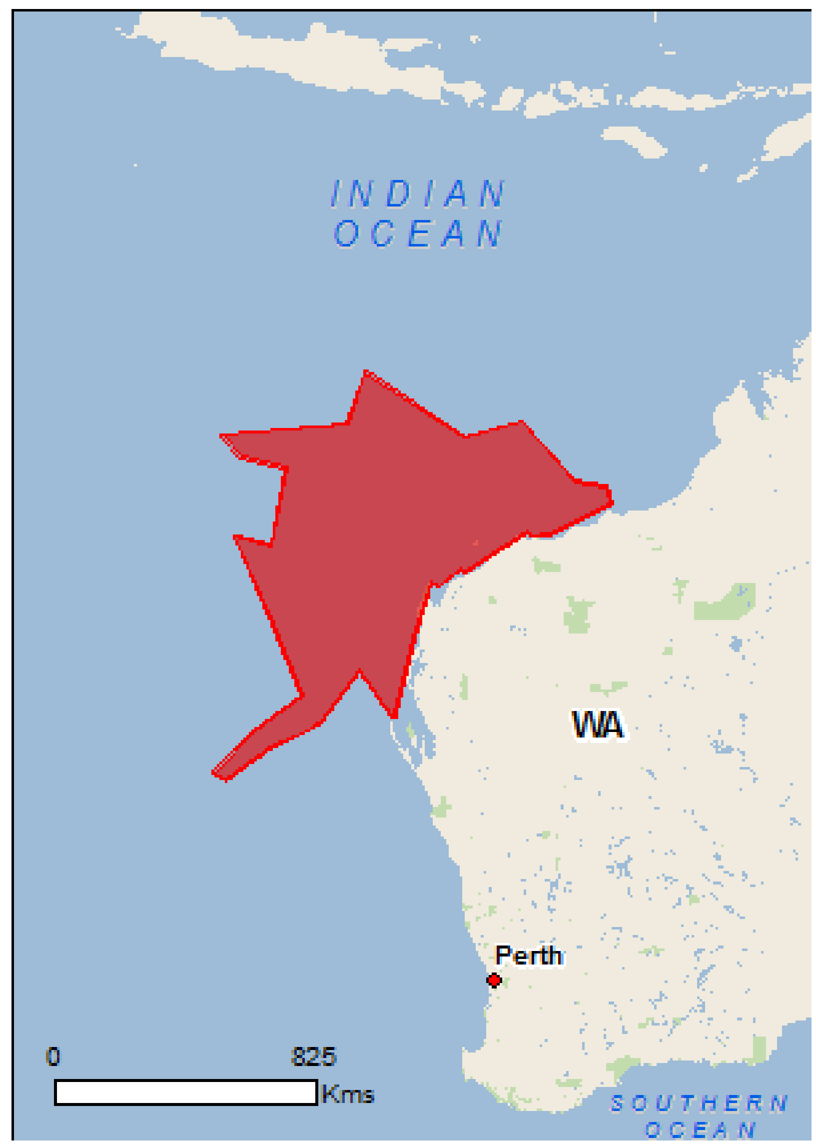
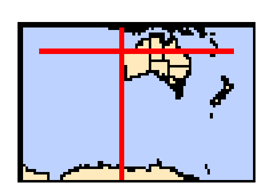


Coordinates

Buffer: 5.0Km



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:	3
Wetlands of International Importance:	None
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	2
Listed Threatened Ecological Communities:	None
Listed Threatened Species:	61
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:	5
Commonwealth Heritage Places:	2
Listed Marine Species:	116
Whales and Other Cetaceans:	32
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:	30
Regional Forest Agreements:	None
Invasive Species:	18
Nationally Important Wetlands:	3
Key Ecological Features (Marine)	8

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
Indigenous		
Dampier Archipelago (including Burrup Peninsula)	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
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
South-west

Listed Threatened Species [Resource Information]

Name	Status	Type of Presence
Birds		
Anous tenuirostris melanops Australian Lesser Noddy [26000]	Vulnerable	Species or species habitat may 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
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

Name	Status	Type of Presence
		area
Falco hypoleucos Grey Falcon [929]	Vulnerable	Species or species habitat known to 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 edouardi White-winged Fairy-wren (Barrow Island), Barrow Island Black-and-white Fairy-wren [26194]	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 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
Fish		
Milyeringa veritas Blind Gudgeon [66676]	Vulnerable	Species or species habitat known to occur within area
Ophisternon candidum Blind Cave Eel [66678]	Vulnerable	Species or species habitat known to occur within area

Name	Status	Type of Presence
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
Bettongia lesueur lesueur Burrowing Bettong (Shark Bay), Boodie [66659]	Vulnerable	Species or species habitat known to occur within area
Dasyurus hallucatus Northern Quoll, Digul [Gogo-Yimidir], Wijingadda [Dambimangari], Wiminji [Martu] [331]	Endangered	Species or species habitat known to occur within area
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
Lagorchestes conspicillatus conspicillatus Spectacled Hare-wallaby (Barrow Island) [66661]	Vulnerable	Species or species habitat known to occur within area
Lagorchestes hirsutus Central Australian subspecies Mala, Rufous Hare-Wallaby (Central Australia) [88019]	Endangered	Translocated population known to occur within area
Lagorchestes hirsutus bernieri Rufous Hare-wallaby (Bernier Island) [66662]	Vulnerable	Species or species habitat known to occur within area
Lagorchestes hirsutus dorreae Rufous Hare-wallaby (Dorre Island) [66663]	Vulnerable	Species or species habitat known to occur within area
Lagostrophus fasciatus fasciatus Banded Hare-wallaby, Merrnine, Marnine, Munning [66664]	Vulnerable	Species or species habitat known 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	Breeding known to occur within area
Osphranter robustus isabellinus Barrow Island Wallaroo, Barrow Island Euro [89262]	Vulnerable	Species or species habitat likely to occur within area
Perameles bougainville bougainville Western Barred Bandicoot (Shark Bay) [66631]	Endangered	Species or species habitat known to occur within area
Petrogale lateralis lateralis Black-flanked Rock-wallaby, Moororong, Black-footed Rock Wallaby [66647]	Endangered	Species or species habitat known to occur within area
Pseudomys fieldi Shark Bay Mouse, Djoongari, Alice Springs Mouse	Vulnerable	Species or species

Name	Status	Type of Presence
[113]		habitat likely to occur within area
Rhinonicteris aurantia (Pilbara form)		
Pilbara Leaf-nosed Bat [82790]	Vulnerable	Species or species habitat known to occur within area
Other		
Kumonga exleyi		
Cape Range Remipede [86875]	Vulnerable	Species or species habitat known to 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 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
Ctenotus zastictus		
Hamelin Ctenotus [25570]	Vulnerable	Species or species habitat known to occur within area
Dermochelys coriacea		
Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Foraging, feeding or related behaviour known to occur within area
Eretmochelys imbricata		
Hawksbill Turtle [1766]	Vulnerable	Breeding known to occur within area
Lerista nevinae		
Nevin's Slider [85296]	Endangered	Species or species habitat likely to occur within area
Liasis olivaceus barroni		
Olive Python (Pilbara subspecies) [66699]	Vulnerable	Species or species habitat 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 habitat known to 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	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]		Foraging, feeding or related behaviour 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
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]		Breeding known 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
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
Sterna dougallii Roseate Tern [817]		Breeding known to occur within area
Sula dactylatra Masked Booby [1021]		Breeding known to occur within area
Sula leucogaster Brown Booby [1022]		Breeding known to occur within area
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

Name	Threatened	Type of Presence
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 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 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
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

Name	Threatened	Type of Presence
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 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	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

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
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
Limnodromus semipalmatus Asian Dowitcher [843]		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 known 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 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 - EXMOUTH ADMIN & HF TRANSMITTING
Defence - EXMOUTH VLF TRANSMITTER STATION
Defence - LEARMONTH - AIR WEAPONS RANGE
Defence - LEARMONTH RADAR SITE - VLAMING HEAD EXMOUTH

Commonwealth Heritage Places [Resource Information]

Name	State	Status
Natural		
Learmonth Air Weapons Range Facility	WA	Listed place
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

Name	Threatened	Type of Presence
Anous stolidus Common Noddy [825]		Species or species habitat likely to occur within area
Anous tenuirostris melanops Australian Lesser Noddy [26000]	Vulnerable	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
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
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 veredus Oriental Plover, Oriental Dotterel [882]		Species or species habitat may occur within area
Chrysococcyx osculans Black-eared Cuckoo [705]		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
Fregata ariel Lesser Frigatebird, Least Frigatebird [1012]		Breeding known 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

Name	Threatened	Type of Presence
		habitat known 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
Larus pacificus Pacific Gull [811]		Breeding known to occur within area
Limnodromus semipalmatus Asian Dowitcher [843]		Species or species habitat 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
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
Papasula abbotti Abbott's Booby [59297]	Endangered	Species or species habitat may occur within area
Pterodroma mollis Soft-plumaged Petrel [1036]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Puffinus carneipes Flesh-footed Shearwater, Fleshy-footed Shearwater [1043]		Foraging, feeding or related behaviour 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 likely 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

Name	Threatened	Type of Presence
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
Sula dactylatra Masked Booby [1021]		Breeding known to occur within area
Sula leucogaster Brown Booby [1022]		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
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 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

Name	Threatened	Type of Presence
		area
Corythoichthys flavofasciatus Reticulate Pipefish, Yellow-banded Pipefish, Network Pipefish [66200]		Species or species habitat may occur within area
Cosmocampus banneri Roughridge Pipefish [66206]		Species or species habitat may occur within area
Doryrhamphus dactyliophorus Banded Pipefish, Ringed Pipefish [66210]		Species or species habitat may occur within area
Doryrhamphus excisus Bluestripe Pipefish, Indian Blue-stripe Pipefish, Pacific Blue-stripe Pipefish [66211]		Species or species habitat may occur within area
Doryrhamphus janssi Cleaner Pipefish, Janss' Pipefish [66212]		Species or species habitat may occur within area
Doryrhamphus multiannulatus Many-banded Pipefish [66717]		Species or species habitat may occur within area
Doryrhamphus negrosensis Flagtail Pipefish, Masthead Island Pipefish [66213]		Species or species habitat may occur within area
Festucalex scalaris Ladder Pipefish [66216]		Species or species habitat may occur within area
Filicampus tigris Tiger Pipefish [66217]		Species or species habitat may occur within area
Halicampus brocki Brock's Pipefish [66219]		Species or species habitat may occur within area
Halicampus grayi Mud Pipefish, Gray's Pipefish [66221]		Species or species habitat may occur within area
Halicampus nitidus Glittering Pipefish [66224]		Species or species habitat may occur within area
Halicampus spinirostris Spiny-snout Pipefish [66225]		Species or species habitat may occur within area
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

Name	Threatened	Type of Presence
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
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
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

Name	Threatened	Type of Presence
Aipysurus eydouxii Spine-tailed Seasnake [1117]		Species or species habitat may occur within area
Aipysurus foliosquama Leaf-scaled Seasnake [1118]	Critically Endangered	Species or species habitat known 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
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
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 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

Name	Threatened	Type of Presence
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 Dolphin, 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
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

Name	Status	Type of Presence
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
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 habitat may occur within area

Australian Marine Parks [Resource Information]

Name	Label
Abrolhos	Habitat Protection Zone (IUCN IV)
Abrolhos	Multiple Use Zone (IUCN VI)

Name	Label
Argo-Rowley Terrace	Multiple Use Zone (IUCN VI)
Carnarvon Canyon	Habitat Protection Zone (IUCN IV)
Dampier	Habitat Protection Zone (IUCN IV)
Dampier	Multiple Use Zone (IUCN VI)
Dampier	National Park Zone (IUCN II)
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)
Montebello	Multiple Use Zone (IUCN VI)
Ningaloo	National Park Zone (IUCN II)
Ningaloo	Recreational Use Zone (IUCN IV)
Shark Bay	Multiple Use Zone (IUCN VI)

Extra Information

State and Territory Reserves [Resource Information]

Name	State
Airlie Island	WA
Barrow Island	WA
Bedout Island	WA
Bernier And Dorre Islands	WA
Bessieres Island	WA
Boodie, Double Middle Islands	WA
Bundegi Coastal Park	WA
Cape Range	WA
Jurabi Coastal Park	WA
Koks Island	WA
Lowendal Islands	WA
Montebello Islands	WA
Muiron Islands	WA
North Sandy Island	WA
North Turtle Island	WA
Round Island	WA
Serrurier Island	WA
Unnamed WA36909	WA
Unnamed WA36910	WA
Unnamed WA36913	WA
Unnamed WA36915	WA
Unnamed WA37338	WA
Unnamed WA37383	WA
Unnamed WA40322	WA
Unnamed WA40828	WA
Unnamed WA40877	WA
Unnamed WA41080	WA
Unnamed WA44665	WA
Unnamed WA44667	WA
Unnamed WA44672	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

Name	Status	Type of Presence
		within area
Streptopelia senegalensis Laughing Turtle-dove, Laughing Dove [781]		Species or species habitat likely to 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 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
Vulpes vulpes Red Fox, Fox [18]		Species or species habitat likely to occur within area
Plants		
Cenchrus ciliaris Buffel-grass, Black Buffel-grass [20213]		Species or species 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
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
Prosopis spp. Mesquite, Algaroba [68407]		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
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
Bundera Sinkhole	WA

Name	State
Cape Range Subterranean Waterways	WA
Learmonth Air Weapons Range - Saline Coastal Flats	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
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
Wallaby Saddle	North-west
Western demersal slope and associated fish	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

-26.9146 108.2355,-26.0311 109.5618,-25.7203 110.4125,-25.4201 110.9639,-24.0838 112.0518,-25.2866 112.9567,-25.2861 113.0302,-23.0727 113.6551,-21.8168 114.0503,-21.8919 114.3131,-21.4264 114.9192,-21.5101 115.0501,-21.3904 115.3062,-20.4203 116.8247,-20.5713 116.9891,-20.5269 117.4466,-19.7123 119.2059,-19.2693 119.0701,-19.1511 118.1984,-17.5247 116.6467,-17.9576 115.025,-16.172 112.1963,-17.576 111.6951,-17.8753 108.1338,-18.4384 108.6585,-18.7422 109.9508,-20.8288 109.5468,-20.5896 108.4952,-22.8932 109.5855,-24.8122 110.4414,-25.6872 109.05,-26.7626 107.895,-26.9146 108.2355

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

Oil Spill Preparedness and Response Mitigation Assessment for Scarborough Seabed Intervention and Trunkline Installation

Security & Emergency Management
Hydrocarbon Spill Preparedness

December 2021
Revision 0

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TABLES

EXECUTIVE SUMMARY

Woodside Energy Scarborough Pty Ltd (Woodside) has developed its oil spill preparedness and response position for the Scarborough Seabed Intervention and Trunkline Installation, hereafter known as the Petroleum Activities Program (PAP) techniques. 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

<table>
<tr><th>Key details of assessment</th><th colspan="2">Summary</th><th>Reference to additional detail</th></tr>
<tr><td>Worst Case Credible Scenario</td><td colspan="2">Credible Scenario-01 (CS-01): A short-term (instantaneous) surface release of 2000 m^3 of marine diesel from a vessel collision outside Mermaid Sound.
Credible Scenario-02 (CS-02): A short-term (instantaneous) surface release of 2000 m^3 of marine diesel from a vessel collision within Montebello Marine Park.
Credible Scenario-03 (CS-03): A short-term (instantaneous) surface release of 2000 m^3 of marine diesel from a vessel collision in the Scarborough field (at the proposed Floating Production Unit (FPU) location).</td><td>Section 2.2</td></tr>
<tr><td>Hydrocarbon Properties</td><td colspan="2">Under constant 5 kn wind conditions approximately 45% of the oil is predicted to evaporate within 24 hours. 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 winds are of a greater strength, more entrainment of oil into the water column is predicted (about 45% after 24 hours). A further 35% is forecast to evaporate, leaving only a small proportion of the oil floating on the water surface (<1%).</td><td>Section 6.7.2 of the EP

Appendix A of the First Strike Plan</td></tr>
<tr><td rowspan="5">Modelling Results</td><td colspan="2">A quantitative, stochastic assessment has been undertaken for credible spill scenarios to help assess the environmental risk of a hydrocarbon spill.
A total of 100-200 replicate simulations were completed for the scenarios 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.
Deterministic modelling was conducted for CS-01 and CS-02 following assessment of stochastic modelling. Shoreline contact above 100 g/m^2 was not predicted from stochastic modelling of CS-02 or CS-03.</td><td>Section 2.3</td></tr>
<tr><td colspan="2">Deterministic Modelling Results</td><td rowspan="4"></td></tr>
<tr><td colspan="2">CS-01 (Outside Mermaid Sound)</td></tr>
<tr><td>Minimum time to shoreline contact (above 100 g/m^2)</td><td>Dampier Archipelago – 53 hours (2.2 days)</td></tr>
<tr><td>Largest volume ashore at any single Response</td><td>Dampier Archipelago – 3 m^3</td></tr>
</table>

<table>
<tr><td rowspan="2"></td><td>Priority Area (RPA) (above 100 g/m²)</td><td></td><td rowspan="2"></td></tr>
<tr><td>Largest total shoreline accumulation (above 100 g/m²) all shorelines</td><td>Dampier Archipelago – 156 g/m²</td></tr>
<tr><td>Net Environmental Benefit Analysis</td><td colspan="2">Identified as potentially having a net environmental benefit (dependent on the actual spill scenario) and carried forward for further assessment are:
• Monitor and evaluate
• Shoreline clean-up
• Source control via vessel SOPEP (Ship Oil Pollution Emergency Plan)
• Oiled wildlife response
• Shoreline protection and deflection
• Scientific monitoring programs</td><td>Section 4</td></tr>
<tr><td>ALARP evaluation of selected response techniques</td><td colspan="2">The evaluation of the selected response techniques shows the proposed controls reduced the risk to an ALARP and acceptable level for the risk are presented in Section 2, without the implementation of considered additional, alternative or improved control measures.</td><td>Section 6</td></tr>
</table>

1 INTRODUCTION

1.1 Overview

Woodside Energy Scarborough Pty Ltd (Woodside) has developed its oil spill preparedness and response position for the Scarborough Seabed Intervention and Trunkline Installation activity, 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* (OPGGS Environment Regulations) relating to hydrocarbon spill response arrangements.

- The Scarborough Seabed Intervention and Trunkline Installation Environment Plan (EP)
- Oil Pollution Emergency Arrangements (OPEA) (Australia)
- The Scarborough Seabed Intervention and Trunkline Installation Oil Pollution Emergency Plan (OPEP) including
  - First Strike Response Plan
  - Relevant Operations Plans
  - Relevant Tactical Response Plans (TRPs, also see ANNEX E)
  - 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 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 content of 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 (PAP) is shown in Figure 3-2 of the EP.

1.4 Oil spill response document overview

The documents outlined in Table 1-1 and Figure 1-1 are collectively used to manage the preparedness and response for a hydrocarbon release.

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 Management Team (IMT). In some instances, technical specialists may be utilised to provide expert advice. The planning may also involve liaison officers from supporting government agencies.

During each operational period, field reports are continually reviewed to evaluate the effectiveness of response operations. In addition, the operational NEBA is continually reviewed and updated to ensure the response techniques implemented continue to result in a net environmental benefit (see **Section 4**).

The response will continue as described in **Section 5** until the response termination criteria have been met, as set out in ANNEX B: Operational Monitoring Activation and Termination Criteria.

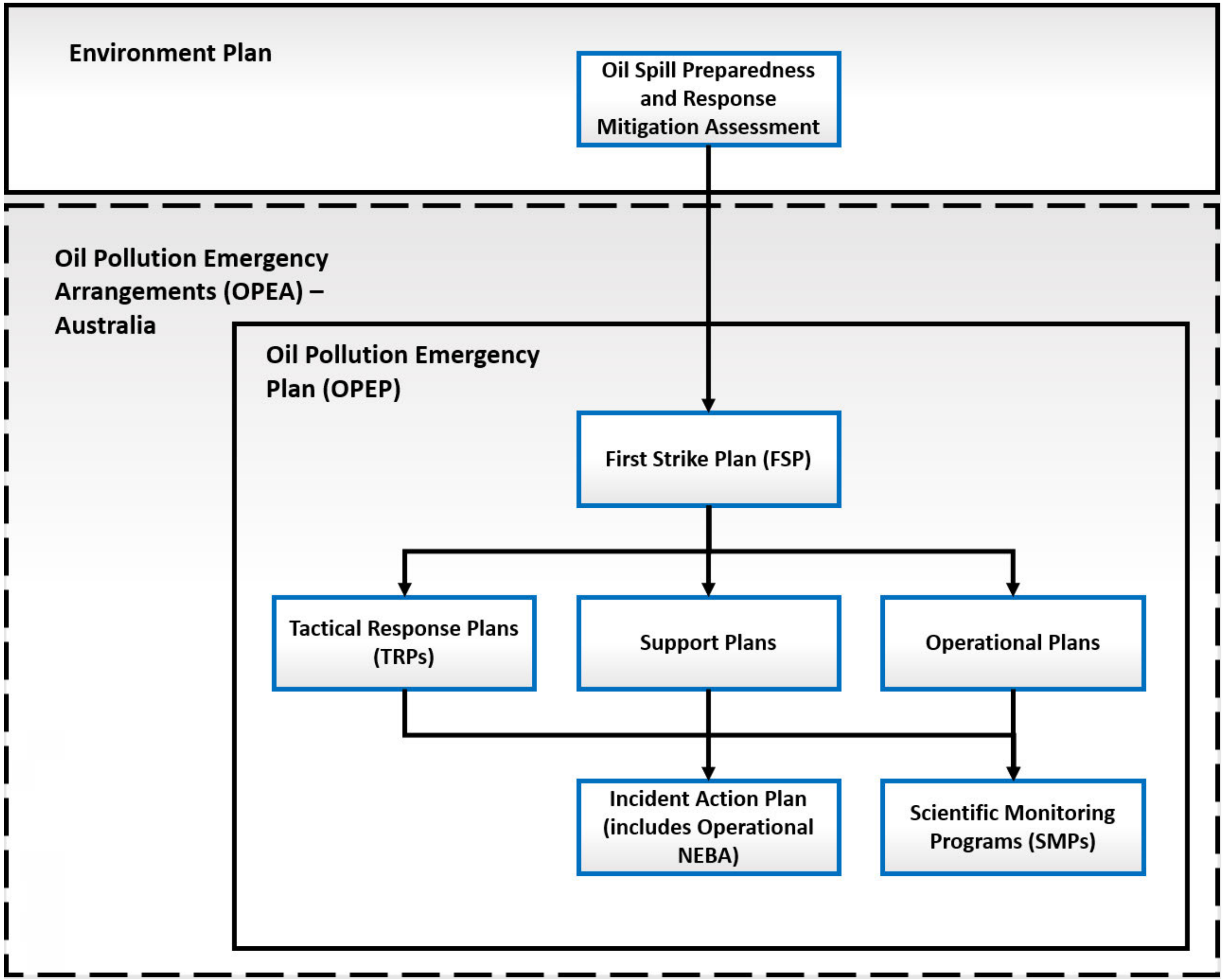

Figure 1-1: Example of Woodside hydrocarbon spill document structure

Table 1-1: Hydrocarbon Spill preparedness and response – document references

Document	Document overview	Stakeholders	Relevant information	Document Details (where relevant)
Scarborough Seabed Intervention and Trunkline Installation Environment Plan (EP)	Demonstrates that potential adverse impacts on the environment associated with the Scarborough Seabed Intervention and Trunkline Installation (during both routine and non-routine operations) are	NOPS EMA Woodside internal	EP Section 6 (Identification and evaluation of environmental risks and impacts, including credible spill scenarios) EP Section 7 (Implementation strategy) including: EP Section 7.9 – (Emergency preparedness	

Document	Document overview	Stakeholders	Relevant information	Document Details (where relevant)
	mitigated and managed to As Low As Reasonably Practicable (ALARP) and will be of an acceptable level.		and response) EP Section 7.8 (Reporting and compliance) EP Section 7.9 (Performance outcomes, standards and measurement criteria)	
Oil Pollution Emergency Arrangements (OPEA) Australia	Describes the arrangements and processes adopted by Woodside when responding to	Regulatory agencies Woodside internal	All	

Document	Document overview	Stakeholders	Relevant information	Document Details (where relevant)
	a hydrocarbon spill from a petroleum activity.			
Oil Spill Preparedness and Response Mitigation Assessment for the Scarborough Seabed Intervention and Trunkline Installation (this document)	Evaluates response options to address the potential environmental impacts resulting from an unplanned loss of hydrocarbon containment associated with the	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.	

Document	Document overview	Stakeholders	Relevant information	Document Details (where relevant)
	PAP described in the EP.			

Scarborough Seabed Intervention and Trunkline Installation 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	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. Activatio	

Document	Document overview	Stakeholders	Relevant information	Document Details (where relevant)
	Strike Response Plans are intended to be the first document used to provide immediate guidance to the responding Incident Management Team (IMT).		n process for oil spill trajectory modelling (OSTM), aerial surveillance and oil spill tracking buoy details.	
Operational Plans	Lists the actions required to activate, mobilise and deploy personnel and	CICC: Operations and Logistics functions for first strike activities.	Locations from where resources may be mobilised. How resources will be	Operational monitoring plan Protection and deflection Shoreline clean-up Oiled wildlife Scientific monitoring

Document	Document overview	Stakeholders	Relevant information	Document Details (where relevant)
	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	CICC: Planning Function to help inform the IAP on resources available.	mobilised. Details of where resources may be mobilised to and what facilities are required once the resources arrive. Details on how to use resources to undertake a response.	

Document	Document overview	Stakeholders	Relevant information	Document Details (where relevant)
	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.			

Document	Document overview	Stakeholders	Relevant information	Document Details (where relevant)
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 Scarborough Development oil spill response, refer to References AAM (2014) RapidEye satellite images were captured along the coastline of Central/ Northern, Western Australia in between September 2011 to April 2014. Advisian (2021) Northwest Marine Region Seabird and Shorebird Baseline and Threats Review. Report to Woodside. Advisian (2019) Montebello Marine Park Benthic Habitat Survey ROV Analysis of the Scarborough Pipeline Route. Report Prepared for Woodside Energy Ltd. 183 pp. Abdul Wahab, M, A., Radford, B., Cappo, C., Colquhoun, J., Stowar, M., Depczynski, M., Miller, K and Heyward, A. (2018). Biodiversity and spatial patterns of benthic habitat and associated demersal fish communities at two tropical submerged reef ecosystems. *Coral Reefs*. Vol. 37, Issue 2, pp. 327-343. https://doi.org/10.1007/s00338-017-1655-9 AIMS (2010) Reefs: Ningaloo Reef Biodiversity Expeditions (2008-2010). http://www.aims.gov.au/creefs AIMS (2014a). AIMS 2013 Biodiversity Survey of Glomar Shoal and Rankin Bank. Report prepared by the Australian Institute of Marine Science for Woodside Energy Ltd. Australian Institute of Marine Science, Townsville. October 2014 Rev 1,153pp. AIMS (2014b). AIMS 2014 Extended Benthic Models and Habitat Maps of Rankin Bank. Report prepared by the Australian Institute of Marine Science for Woodside Energy Ltd. Australian Institute of Marine Science, Townsville. December 2014 Rev 0 (43pp.). AIMS (2015). Ningaloo and Outer Shark Bay Baseline Survey 2014. AIMS Field Report for Woodside. 21 pp. Co-funded Baseline Surveys (November-December 2014). AIMS (2017) Juvenile fish recruitment surveys, Ningaloo Reef, Western Australia (WAMSI Node 3 Project 3.1.2). https://data.gov.au/dataset/juvenile-fish-recruitment-surveys-ningaloo-reef-western-australia-wamsi-node-3-project-3-1-2 AMOSC/DPAW (2014). Inter-Company Oil Spill Wildlife Response Plan – Pilbara region. pp. 272 http://www.dpaw.wa.gov.au/images/documents/conservation-management/marine/wildlife/PROWRP_20141103.pdf

Document	Document overview	Stakeholders	Relevant information	Document Details (where relevant)
				Astron Environmental Service (2014). Exmouth Islands Turtle Monitoring Program January 2014 Field Survey. Report prepared on behalf of Apache Energy/Quadrant Energy (now Santos). Babcock R, Donovan A, Collin S and Ochieng-Erftemeijer C (2017). Pilbara Marine Conservation Partnership – Final Report – Volume 2 (Part III: Coral Reef Health). CSIRO Oceans & Atmosphere, Published Brisbane. https://research.csiro.au/pmcp/pmcp-publications/ Bancroft, K.P. (2009). Establishing long-term coral community monitoring sites in the Montebello/ Barrow Islands marine protected areas: data collected in December 2006. Marine Science Program Data Report Series MSPDR4. January 2009. Marine Science Program, Science Division, Department of Environment and Conservation, Perth, Western Australia. 68p. Bamford M.J. (2004). Gorgon Development on Barrow Island. Technical Report: Avifauna Bamford and Moro (2011). Barrow Island as an important bird area for migratory waders in the East Asian – Australasian Flyway. Stilt 60: 46–55 BirdLife Australia (2018) Seabird and Shorebird Baseline Studies, Ningaloo Region – Report on January 2018 bird surveys. Interim Report for Woodside Energy Ltd. BirdLife Australia (2017) Shorebirds 2020 programme – Data Extraction (1993-2017). http://www.birdlife.org.au/projects/shorebirds-2020 Cannell B, Hamilton S and Driessen (2019). Wedge-tailed Shearwater foraging behaviour in the Exmouth Region. Final Report. Report prepared for Woodside Energy Limited. The University of Western Australia and BirdLife, pp.36. Cassata, L. and L.B. Collins (2008). Coral reef communities, habitats and substrates in and near Sanctuary Zones of Ningaloo Marine Park. Journal of Coastal Research Vol. 24 (1): 139-51. Chevron Australia (2010). Gorgon Gas Development and Jansz Feed Gas Pipeline: Coastal and Marine Baseline State and Environmental Impact Report: Domestic Gas Pipeline. Document Number: G1-NT-REPX0002750 http://www.chevronaustralia.com/Libraries/Chevron_Documents/Gorgon_Project_Coastal_and_Marine_Baseline_State_and_Environmental_Impact_Report_Domestic_Gas_Pipeline.pdf.sflb.ashx

Document	Document overview	Stakeholders	Relevant information	Document Details (where relevant)
				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 Chevron Australia (2013). Wheatstone Project, Oil Spill Operational Scientific Monitoring Program-OPS 5 Shorebird and Seabird Rapid Assessment. Document Number: WS0-0000-HESRPT-CVX-000-00144-000. https://www.chevronaustralia.com/docs/default source/defaultdocument-library/wheatstone-ops5-shorebird-and-seabird-rapid-assessment.pdf?sfvrsn=2 Chevron Australia (2014). Gorgon Gas Development and Jansz Feed Gas Pipeline: Post-Development Coastal and Marine State and Environment Impact Survey Report, Year 2:2012-2013. Document number G1-NT-REPX0005152. Pp. 362 https://www.chevronaustralia.com/docs/default-source/default-document-library/gorgon-emp-post-development-coastal-and-marine-state-and-environmental-impact-survey.pdf?sfvrsn=4 Colquhoun J and Heyward A. (eds) (2008). WAMSI Node 3 Project 1 Subproject 3.1.1 Deepwater Communities at Ningaloo Marine Park: Ningaloo Reef Marine Park Deepwater Benthic Biodiversity Survey Annual Report 2007. 209 pp. http://www.wamsi.org.au/sites/default/files/Node%203.1.1%20Ningaloo%20Reef%20Marine%20Park.pdf CSIRO (2020). Highlights Report – Ningaloo Outlook Program. https://research.csiro.au/ningaloo/outlook/shallow-reefs/shallow-reefs-research-2015-2020/ Currey-Randall L, Wakeford M, Colquhoun J, Cappo M, Stowar M, Birt M, Cure K, Vaughan B, Case M, Fisher R and Miller KJ (2019) Temporal trends in benthic communities and demersal fishes at Rankin Bank and Glomar Shoal. Report prepared for Woodside Energy Ltd. Australian Institute of Marine Science, Perth. 59 pp. Department of Biodiversity, Conservation and Attractions (DBCA) (2021). High Resolution Photogrammetry Surveys for marine turtle nesting beaches of the Dampier Archipelago during peak nesting season 2019-2020.

Document	Document overview	Stakeholders	Relevant information	Document Details (where relevant)
				Department of Environment and Conservation (DEC), 2007, Management Plan for the Montebello/Barrow Islands Marine Conservation Reserves 2007-2017, Marine Management Plan No. 55, DEC, Perth, WA. Depczynski M, Heyward A, Wilson S, Holmes T, Case M, Colquhoun J, O'Leary RA, Radford B (2011). Methods of monitoring the health of benthic communities at Ningaloo – Coral & Fish recruitment. WAMSI Node 3 Project 3.1.2. Final Report to the Western Australian Marine Science Institution, Perth. 101 pp. http://www.wamsi.org.au/research-ningaloo/node-3-reports EOMAP. (2017). Atmospheric correction and land cover classification, NW Cape. Report prepared for Woodside Energy Ltd. Fitzpatrick B.M., Harvey E.S., Heyward A.J., Twiggs E.J. and Colquhoun J. (2012). Habitat Specialization in Tropical Continental Shelf Demersal Fish Assemblages. PLoS ONE 7(6): e39634. doi:10.1371/journal.pone.0039634 http://www.plosone.org/article/info%3Adoi%2F10.1371%2Fjournal.pone.0039634 Hutchins, J.B. (2004). Fishes of the Dampier Archipelago, Western Australia. *Records of the Western Australian Museum* Supplement No. 66: 343-398. Johnstone R.E, Burbidge A. H, Darnell J.C. (2013). Birds of the Pilbara Region, including seas and offshore islands, Western Australia: distribution, status and historical changes. Records of the Western Australian Museum, Supplement 78: 343-441. http://museum.wa.gov.au/sites/default/files/WAM_Supp78(B)_JOHNSTONEetal%20pp343-441_0.pdf Joint Carnarvon Basin Operators (2012). Draft Joint Carnarvon Basin Operators North West Cape Sensitivity Mapping. Part A. (Apache Energy Ltd, Woodside Energy Ltd, BHP Billiton and the Australian Marine Oil Spill Centre Pty Ltd (AMOSC). Keesing, J., K. (2019). Benthic habitats and biodiversity of the Dampier Archipelago and Montebello Australian Marine Parks. Report of the Director of Nationals Parks. CSIRO, Australia Keulen, M. Vand Langdon, M.W. (2011) Ningaloo Collaboration Cluster: Biodiversity and ecology of the Ningaloo Reef lagoon. Final Report No. 1c.

Document	Document overview	Stakeholders	Relevant information	Document Details (where relevant)
				http://www.ningaloo.org.au/www/en/NingalooResearchProgram/Publications/Cluster-finalreports.html Kobryn, H.T., Wouters, K., Beckley, L.E. and T. Heege (2013). Ningaloo Reef: Shallow marine habitats mapped using a Hyperspectral sensor. PLoS ONE 8(7): e70105. doi:10.1371/journal.pone.0070105. http://dx.plos.org/10.1371/journal.pone.0070105 Le Noahic, M., Cornwall, M. E., Comeau, S., McCulloch, M. T. and Schoepf, V. (2017). Marine heatwave causes unprecedented regional mass bleaching of thermally resistant corals in northwestern Australia. *Scientific Reports,* vol. 7, doi: 10.1038/s41598-017-14794-y McLean, D., Taylor M., Vaughan B. (2019) Marine Communities of the Pluto Trunkline within the Montebello Marine Park. Report prepared for Woodside Energy Ltd. Australian Institute of Marine Science, Perth. 45 pp. Pendoley Environment (2005). Proposed Gorgon Development: Sea turtle Monitoring program results November 2004 to February 2005. Report for Chevron Australia. Pendoley, K. (2009). Marine Turtle Beach Survey. Onslow Mainland Area and Nearby Islands. Report to URS for the Chevron Wheatstone Project Team, 91 pp. https://www.chevronaustralia.com/Files/PDF/Wheatstone%20Draft%20EIS_ERMP%20Technical%20Appendices%20O8%20to%20O12%20and.pdf Pitcher, C.R., Miller, M., Morello, E., Fry, G., Strzelecki, J., McLeod, I., Slawinski, D., Ellis, N., Thomson, D., Bearham, D., Keesing, J., Donovan, A., Mortimer, N. Babcock, R., Fromont, J, Gomez, O., Hosie, A., Hara, A., Moore, G., Morrison, S., Kirkendale, L., Whisson, C., Richards, Z., Bryce, M., Marsh, L., Naughton, K., O'Loughlin, M., O'Hara, T., Boddington, D., Huisman, J. (2016) Environmental Pressures: Regional Biodiversity — Pilbara Seabed Biodiversity Mapping & Characterisation. Final report, CSIRO Oceans & Atmosphere, Published Brisbane, March 2016, 62 pages Quadrant Energy - Seabird Monitoring - Lowendal, Airlie, Serrurier islands - 1994 to present. Industry-Government Environmental Meta-database (IGEM). UUID: bdd428fe-cf24-4596-a822-cd578695ee16. Accessed June 2017

Document	Document overview	Stakeholders	Relevant information	Document Details (where relevant)
				Rob D, Barnes P, Whiting S, Fossette S, Tucker T and Mongan T (2019) Turtle activity and nesting on the Muiron Islands and Ningaloo Coast: Final Report 2018, Ningaloo Turtle Program. Report prepared for Woodside Energy Limited. Department of Biodiversity, Conservation and Attractions, Exmouth, pp.51. RPS-Bowman Bishaw Gorham (2005). Gorgon Development on Barrow Island, Technical Report, Marine Benthic Habitats. Prepared for Chevron Australia. https://www.chevronaustralia.com/docs/default-source/default-document-library/c8_marine_benthic_habitats.pdf?sfvrsn=0 RPS (2012). Pipeline Corridor Biological Seabed Survey: Apache Julimar Development Project – Field Report. Prepared for Apache Energy Limited, October 2011. Stevens, J.D., Last, P.R., White, W.T., McAuley, R.B., Meekan, M.G. (2009) Diversity, abundance and habitat utilisation of sharks and rays. CSIRO Marine and Atmospheric Research. Final report to Western Australian Marine Science Institute Surman CA and Nicholson LW (2015). Exmouth Sub basin Marine Avifauna Monitoring Program: Final Report. Unpublished report prepared for Apache Energy Ltd. by Halfmoon Biosciences. 188 pp. Surman CA and Nicholson LW (2012) Monitoring of annual variation in seabird breeding colonies throughout the Lowendal Group of islands: 2012 Annual Report. Unpublished report prepared for Apache Energy Ltd. by Halfmoon Biosciences. Tucker T, Fossette S, Whiting S, Rob, D and Barnes P (2019) Spatial and temporal use of inter-nesting habitat by sea turtles along the Muiron Islands and Ningaloo Coast. Final Report. Report prepared for Woodside Energy Limited. Department of Biodiversity, Conservation and Attractions, Kensington, pp.77. URS Australia Pty Ltd (2010). Biota of Subtidal Habitats in Pilbara Mangroves with Particular Reference to the Ashburton Delta and Hooley Creek, Technical Appendix N13. In: Technical Appendices N11 to N15 and O1 to O7. Draft Environmental Impact Statement/Environmental Review and Management Programme for the Proposed Wheatstone Project. July 2010, pp 124-245 https://www.chevronaustralia.com/Files/PDF/Wheatstone%20Draft%20EIS_ERMP%20Tech

Document	Document overview	Stakeholders	Relevant information	Document Details (where relevant)
				Watson, D.L., Harvey, E.S., Fitzpatrick, B.M. et al. Mar Biology (2010) Assessing reef fish assemblage structure: how do different stereo-video techniques ANNEX E: Tactical Response Plans (or here).
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 & Global Capability Surge Labour Requirement Plan Health & Safety Aviation IT (First Strike Response) IT (Extended Response) Communications (First Strike Response) Communications (Extended Response) Stakeholder Engagement Accommodation & Catering Waste Management Guidance for Oil Spill Claims Management (Land based) Hydrocarbon Spill Responder Health Monitoring Guideline

2 RESPONSE PLANNING PROCESS

This document details Woodside's process for identifying potential response options for the hydrocarbon release scenarios, identified in the EP. Figure 2-1 outlines the interaction between Woodside's response, planning/preparedness and selection process.

This structure has been used because it shows how the planning and preparedness activities inform a response and provides indicative guidance on what activities would be undertaken, in sequential order, if a real event were to occur. The process also evaluates alternative, additional and/or improved control measures specific to the PAP.

The Scarborough Seabed Intervention and Trunkline Installation First Strike Response Plan then summarises the outcome of the response planning process and provides initial response guidance and a summary of ongoing response activities, if an incident were to occur.

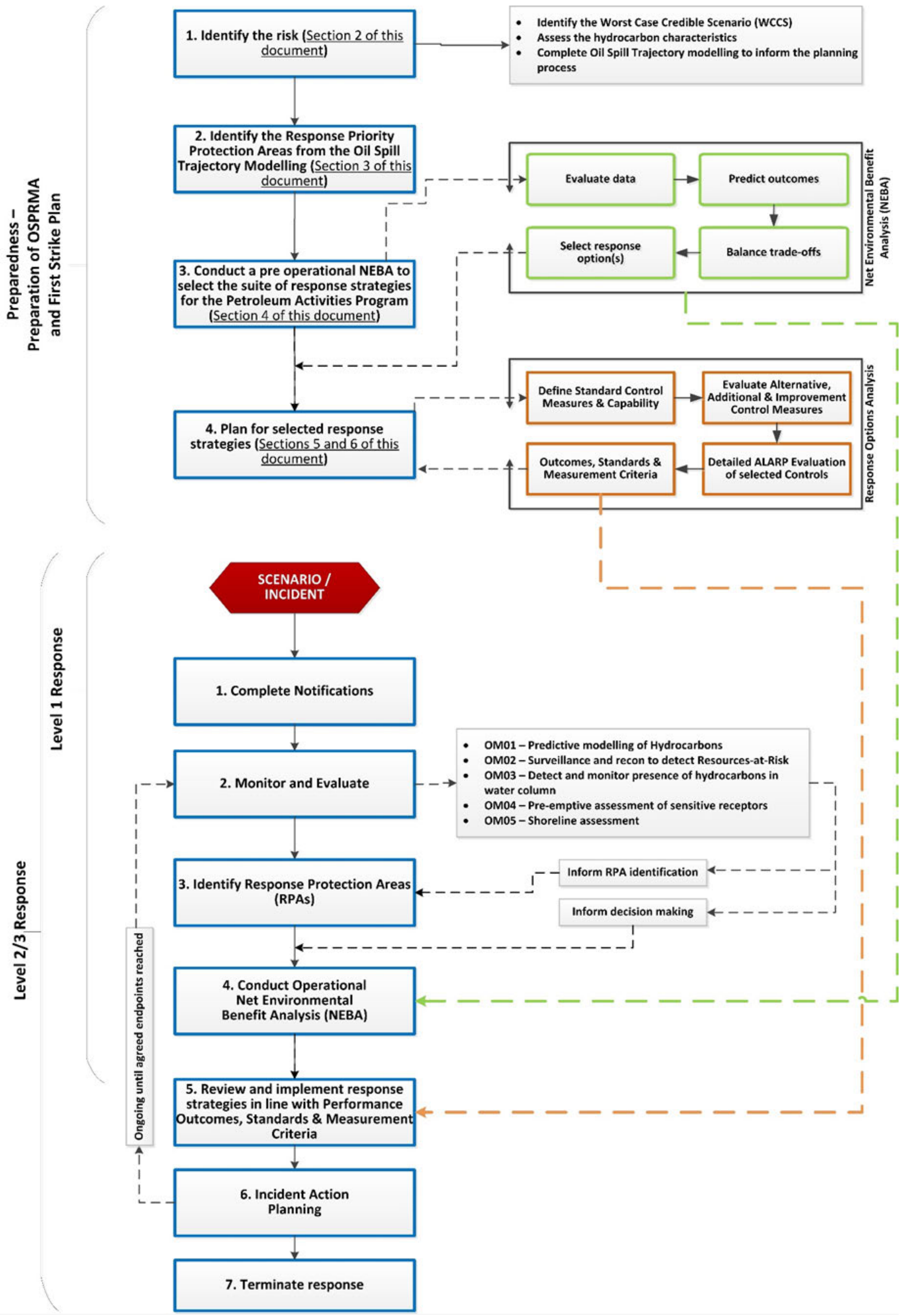

Figure 2-1: Response planning and selection process

2.1 Response planning process outline

This document is expanded below to provide additional context on the key steps in determining capability, evaluating ALARP and hydrocarbon spill response requirements.

Section 1. INTRODUCTION

Section 2. RESPONSE PLANNING PROCESS

- Identification of worst-case credible scenario(s) (WCCS)
- Spill modelling for WCCS.

Section 3. IDENTIFY RESPONSE PROTECTION AREAS (RPAs)

- Areas predicted to be contacted at concentration >100 g/m^2 [1].

Section 4. NET ENVIRONMENTAL BENEFIT ANALYSIS (NEBA)

- Pre-operational NEBA (during planning/ALARP evaluation): this must be reviewed during the initial response to an incident to ensure its accuracy
- Selected response techniques prioritised and carried forward for ALARP assessment.

Section 5. HYDROCARBON SPILL ALARP PROCESS

- Determines the response need based on predicted consequence parameters.
- Details the environmental performance of the selected response options based on the need.
- Sets the environmental performance outcomes, environmental performance standards and measurement criteria.

Section 6. ALARP EVALUATION

- Evaluates alternative, additional, and improved options for each response technique to demonstrate the risk has been reduced to ALARP.
- Provides a detailed ALARP assessment of selected control measure options against:
  - predicted cost associated with implementing the option
  - predicted change to environmental benefit
  - predicted effectiveness / feasibility of the control measure.

Section 7. ENVIRONMENTAL RISK ASSESSMENT OF SELECTED RESPONSE TECHNIQUES

- Evaluation of impacts and risks from implementing selected response options.

Section 8. ALARP CONCLUSION

Section 9. ACCEPTABILITY CONCLUSION

[1] This represents the threshold that could impact the survival and reproductive capacity of benthic epifaunal invertebrates living in intertidal habitat.

2.1.1 Response planning assumptions – timing, resourcing and effectiveness

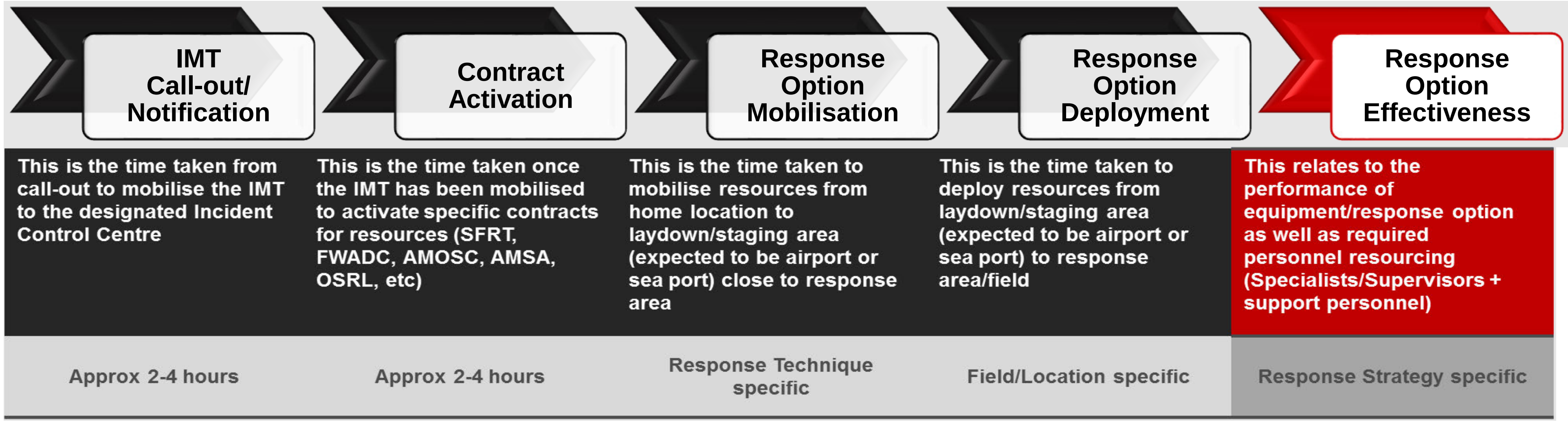

Figure 2-2: Response Planning Assumptions – Timing, Resourcing and Effectiveness

2.2 Environment plan risk assessment (credible spill scenarios)

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. Three 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.

Stochastic modelling has been completed for a worst case spill scenario of an instantaneous surface release of 2000 m^3 of marine diesel, the volume of the largest single fuel tank. The modelling results are representing loss of vessel fuel tank integrity after a collision, at three locations: outside Mermaid Sound (CS-01), within Montebello Marine Park (CS-02) and at the proposed Floating Production Unit (FPU) location in the Scarborough field (CS-03). The surface release of marine diesel caused by vessel collision (CS-01, CS-02 or CS-03) has been considered for response planning purposes, given the large volume released instantaneously. Marine fuel loss during bunkering (CS-04) has a significantly smaller marine diesel release volume of a maximum of 55 m^3, based on a 15 min delay to shut off pumps and a maximum transfer rate of 220 m^3/h, Hydraulic fluid loss of up to 8 m^3 from hydraulically actuated equipment (Scenario 5) is also considered credible. Both a 55 m^3 bunkering spill and 8 m^3 hydraulic fluid spill are considered to be within the risk profile and spill response capability requirements of CS-01, CS-02 or CS-03.

Table 2-1: Petroleum Activities Program credible spill scenarios

Scenario	Scenario selected for planning purposes	Scenario description	Maximum credible volume released (liquid m³)	Incident Level	Hydrocarbon (HC) type	Residual proportion	Residual volume (liquid m³)
CS-01	Yes	Short-term (instantaneous) surface release of marine diesel after a vessel collision outside Mermaid Sound.	2000	2	Marine Diesel	5.0 %	100
CS-02	Yes	Short-term (instantaneous) surface release of marine diesel after a vessel collision within Montebello Marine Park.	2000	2	Marine Diesel	5.0 %	100
CS-03	Yes	Short-term (instantaneous) surface release of marine diesel after a vessel collision at the FPU location in the Scarborough field.	2000	2	Marine Diesel	5.0 %	100
CS-04	No	Marine fuel loss during bunkering: Short-term (instantaneous) release of marine diesel	55	1	Marine Diesel	5.0 %	2.75
CS-05	No	Loss of containment from hydraulic systems of hydraulically actuated equipment	8	1	Hydraulic Fluid	5.0 %	0.4

2.2.1 Hydrocarbon characteristics

Marine Diesel (API 37.2 by the American Petroleum Institute)

Marine Diesel Oil is typically classed as an International Tanker Owners 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. Under constant 5 kn wind conditions, approximately 45% of the oil is predicted to evaporate within 24 hours. Under these 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 winds are of a greater strength, more entrainment of oil into the water column is predicted (about 45% after 24 hours). A further 35% is forecast to evaporate, leaving only a small proportion of the oil floating on the water surface (<1%).

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.

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 (Spill Impact Mapping and Analysis Program, 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) 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 the following scenarios outlined in **Table 2-1**. CS-01: A short-term (instantaneous) surface release of 2000 m^3 of marine diesel, representing loss of vessel fuel tank integrity after a collision outside Mermaid Sound, CS-02: A short-term (instantaneous) surface release of 2000 m^3 of marine diesel, representing loss of vessel fuel tank integrity after a collision within Montebello Marine Park (MP) and CS-03: A short-term (instantaneous) surface release of 2000 m^3 of marine diesel, representing loss of vessel fuel tank integrity after a collision at the FPU location in the Scarborough field. A quantitative, stochastic assessment has been undertaken for credible spill scenarios to help assess the environmental consequences of a hydrocarbon spill.

Numerous simulations (100-200) were completed 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. Further details relating to the assessments for the scenario can be found in Section 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.

Table 2-2: Summary of thresholds applied to the stochastic hydrocarbon spill modelling to determine the EMBA and environmental impacts

Threshold Scarborough Seabed Intervention and Trunkline Installation	Description
10 g/m^2	Surface hydrocarbon
100 ppb	Entrained hydrocarbon (ppb)
50 ppb	Dissolved aromatic hydrocarbon (ppb)
100 g/m^2	Shoreline accumulation

2.3.2 Deterministic modelling

Woodside uses deterministic modelling results to evaluate risks and impacts and response capability requirements. These results are provided in both shapefile and data table format with each row of the data table representing a 1 km^2 cell. This cell size has been used as it represents the approximate area that a single containment and recovery operation or surface dispersant operation (single sortie or vessel spraying) can effectively treat in one ten (10) hour day. Smaller cell sizes have been considered but would not change the response need as the potential distance between cells would not allow multiple cells to be treated per day by response operations. Additionally, a 1km^2 cell is expected to allow averaging of threshold concentrations and mass across the spatial extent to represent a conservative approach (patches of oil and windrows) to response planning that simulates operational monitoring feedback in a real event.

The deterministic modelling data provides an indication of the response need by displaying the potential surface area and volume that may be treated or recovered by response operations. Existing capability is reviewed to approximate the surface area and volumes that can be treated or removed and a range of alternate, improved and additional options to reduce risks and impacts to as low as reasonably practical (ALARP) are considered.

Woodside recognises that no single response technique will treat all available subsea or surface oil and that a combination of response techniques will be required for the identified scenario. Even with the significant resources available to Woodside through existing capability and third-party resources, the primary offshore response techniques of surface dispersant application and containment and recovery will only treat or recover a minor proportion (<30%) of the available surface hydrocarbons based on previous response experience.

Woodside is committed to a realistic, scalable response capability that is commensurate to the level of risk and able to be practically implemented and feasibly sustained.

2.3.3 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 scientific monitoring program (SMP), however, they do not appropriately represent the thresholds at which an effective response can be implemented. Additional response thresholds are used for response planning and to determine areas where response techniques would be most effective. The deterministic modelling is then used to assess the nature and scale of a response.

In the event of an actual response, existing deterministic 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 deterministic 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 [2]	Code 3 – Dull metallic colour	5 to 50
50	Predicted minimum floating oil threshold for containment and recovery and surface dispersant application [3]	Code 4 – Discontinuous true oil colour	50 to 200
100	Predicted optimum floating oil threshold for containment and recovery and surface dispersant application	Code 5 – Continuous true oil colour	>200
Shoreline hydrocarbon concentration (g/m^2)	**Description**	**National Plan Guidance on Oil Contaminated Foreshores**	**Mass per area (g/m^2)**
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 to 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 Australian Maritime Safety Authority (AMSA, 2015) indicates that spreading of spills of Group II or III products will rapidly decrease slick thickness over the first 24 hours of a spill resulting

[2] Operational monitoring will be undertaken from the outset of a spill whether or not the minimum threshold has been reached. This is needed to assess the nature of the spill and track its location. This will then inform the need for any additional monitoring and/or response techniques.
[3] 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.

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).

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 0.1 mm Bonn Agreement Code 4 - discontinuous true oil colour, or 25% coverage of 0.2 mm Bonn Agreement Code 5 – continuous true oil colour which would represent small patches of thick oil or wind-rows.

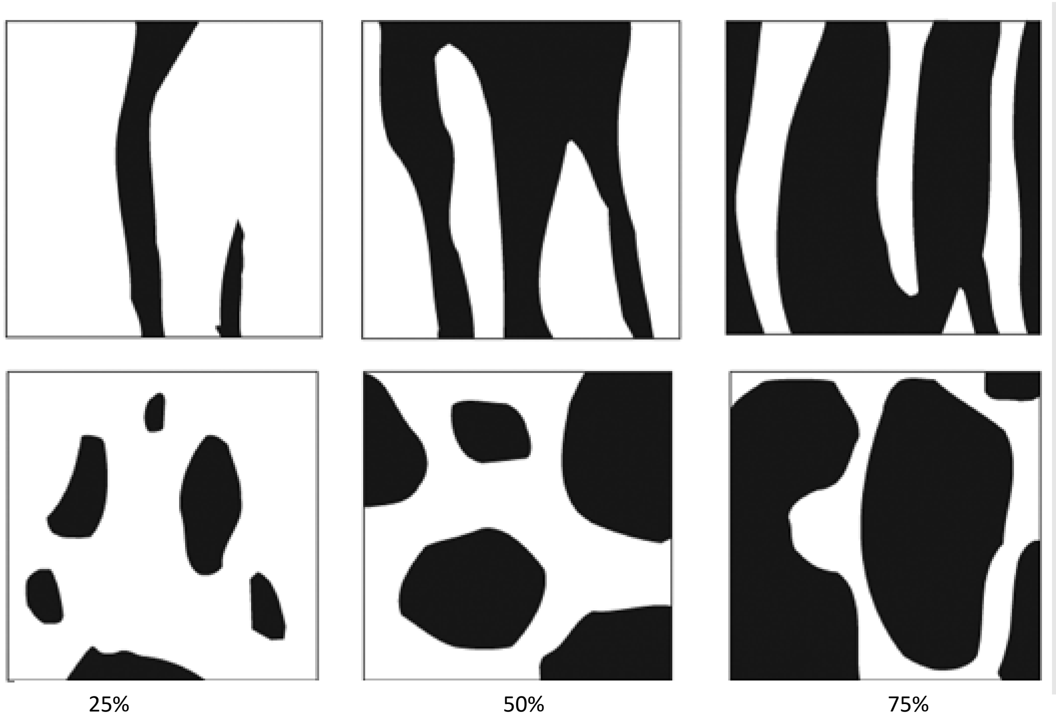

Figure 2-3: Proportion of total area coverage (AMSA, 2014)

Figure 2-4 illustrates the general relationships between on-water response techniques and slick thickness. Windrows, heavy oil patches and tar balls, for example, must be considered, as they influence oil encounter rates, chemical dosages and ignition potential. Each method has different thickness thresholds for effective response.

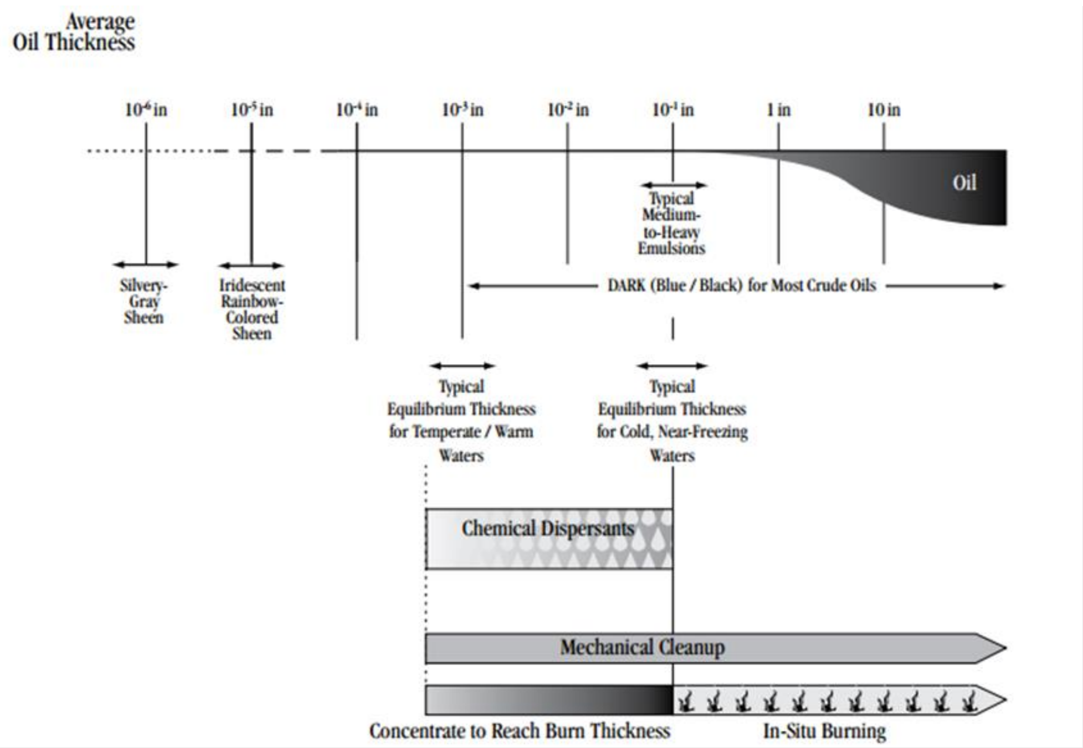

Figure 2-4: Oil thickness versus potential response options (from Allen & Dale 1996)

Wind and 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 (0.6–0.9 m) in height. Waves and wind can also be limiting factors for the safe operation of vessels and aircraft. There is also potential secondary contamination of unimpacted areas and waste issues associated with mechanical dispersion of slicks (**Table 4-3** and **Section 4.2.3.3**).

2.3.4.1 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 1000 or 2000 mPa.s (1000 – 2000 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 2000 or 5000 mPa.s (2000 – 5000 cSt), could be applied to all oils."

However, modern oil spill dispersants are generally effective up to an oil viscosity of 5000 mPa.s (5000 cSt) or more, and their performance gradually decreases with increasing viscosity; oils with a viscosity of more than 10,000 are, in most cases, no longer dispersible. Guidance from the Centre of Documentation, Research and Experimentation (CEDRE; EMSA, 2012) also indicates that products with a range of 500 – 5000 cSt at sea temperature are generally possible to disperse, while 5000 – 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. The potential use of dispersants is evaluated in **Table 4-3**.

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**).

2.3.5 Spill modelling results

Details of the credible scenarios and modelling inputs are included along with deterministic results in **Table 2-5**. Modelling was conducted for all scenarios with three different model outputs being used to determine the worst-case credible parameters. CS-01 provided the WCCS for the shortest time for any oil to drift from the source to both the offshore boundary of a sensitive receptor and to the receptor shoreline, relative to the commencement of the spill.

The selected deterministic runs used to represent the WCCS are:

- Fastest time to shoreline contact (above 100 g/m^2);

- Largest volume ashore at any single RPA (above 100 g/m^2); and
- Largest volume ashore on all shorelines from a single model run (above 100 g/m^2).

Both stochastic and deterministic modelling were completed for CS-01 and CS-02 (although no shoreline contact is predicted for CS-02). Stochastic modelling only was undertaken for CS-03. The deterministic modelling results presented below are therefore derived from the deterministic modelling for CS-01.

Table 2-5: Worst case credible scenario modelling results

Response parameter	Modelled result Marine diesel release caused by vessel collision
Maximum instantaneous liquid hydrocarbon release rate and duration	Worst case spill scenario of an instantaneous surface release of 2000 m^3 of marine diesel, representing loss of vessel fuel tank integrity after a collision: – Outside Mermaid Sound (Scenario 1) – Within Montebello Marine Park (Scenario 2) – In the Scarborough Field (FPU location) (Scenario 3)
Maximum residual surface hydrocarbon after weathering	100 m^3
Deterministic Modelling results	
Minimum time to commencement of hydrocarbon accumulation at any shoreline receptor (at a threshold of 100 g/m^2)	Surface release of Marine Diesel (CS-01) 2.2 days (53 hours) at Dampier Archipelago
Minimum time to floating hydrocarbon contact with the offshore edge(s) of any shoreline receptor polygon (at a threshold of 10 g/m^2)	Surface release of Marine Diesel (CS-01) 1.1 (27 hours) days at Dampier Archipelago
Maximum cumulative hydrocarbon volume accumulated at any individual shoreline receptor	Surface release of Marine Diesel (CS-01) 3 m^3 at Dampier Archipelago
Maximum cumulative hydrocarbon volume accumulated across all shoreline receptors contacted by accumulated hydrocarbons (including those contacted at <100 g/m^2 accumulation concentration)	Surface release of Marine Diesel (CS-01) 156 g/m^2 at Dampier Archipelago
Minimum time to entrained/dissolved hydrocarbon contact with the offshore edges of any receptor polygon (at a threshold of 100 ppb)	1 hour at Montebello Marine Park (CS-02)[4]

From the above deterministic modelling results, the volumes and timeframes have been considered as the basis for response planning and are included in **Section 4.2**. Further stochastic modelling results for the three credible spill scenarios are summarised below.

CS-01 (outside Mermaid Sound):

- Surface hydrocarbon concentrations greater than 10 g/m^2 may occur up to 18 km from the release location.
- Floating oil at the 10 g/m^2 threshold is predicted to arrive at the surface waters of the Montebello MP with a probability of 100% after 1 hour, at the Dampier Archipelago receptor with a probability of 2% after 27 hours, at Dampier MP with a probability of 2% after 37 hours and at Gascoyne MP with a probability of 1% after 64 hours.

[4] From stochastic modelling

- Potential for accumulation of oil on shorelines is predicted to be low, with a maximum accumulated volume and concentration of 3 m^3 and 156 g/m^2, respectively, forecast at the Dampier Archipelago.
- Shorelines accumulation greater than the 100 g/m^2 threshold is predicted to occur at Dampier Archipelago after 2.2 days with a maximum shoreline accumulation of 156 g/m^2.
- The Dampier Archipelago is predicted to be exposed to entrained hydrocarbons greater than 100 ppb within 14 days.
- No other shoreline location exposed to entrained hydrocarbons greater than 100 ppb over timescales longer than 14 days are predicted to accumulate hydrocarbons >100 g/m^2.
- Numerous islands, banks, shoals and mainland locations may be exposed to entrained hydrocarbons greater than 100 ppb within 14 days.
- Spreading and weathering of the surface oil occurs rapidly due to the loss of light, volatile components and the spreading. Dispersant application and containment and recovery are not appropriate for use on spills of marine diesel due to these weathering characteristics.

CS-02 (Within Montebello MP):

- Surface hydrocarbons greater than the 10 g/m^2 threshold could potentially be found up to 39 km from the spill site. Given that this spill location lies within the Montebello AMP receptor area, floating oil at concentrations equal to or greater than 100 g/m^2 are forecast with a probability of 100%. Probabilities of floating oil contact at the 10 g/m^2 threshold not predicted for other receptors.
- Entrained oil at concentrations equal to or greater than the 100 ppb threshold is predicted to be found up to around 630 km from the spill site. The following receptors are predicted to receive entrained oil concentrations at the 100 ppb threshold with probabilities in parenthesis: Montebello Marine Park (78%), Muiron Islands Marine Management Area – World Heritage Area (MMA-WHA, 13%), Argo-Rowley Terrace MP (1%), Barrow Island (5%), Montebello Islands (8%), Ningaloo Coast (Middle, Middle WHA, North, North WHA, max. 12%), Ningaloo RUZ (12%), Pilbara Islands – Southern Island Group (5%), Rankin Bank (1%), Shark Bay (Open Coast and WHA, 1% and 1%, respectively), Bernier & Dorre Islands (1%), Lowendal Islands (1%), Montebello State Marine Park (13%), Muiron Islands (11%), Gascoyne Marine Park (11%) and WA Coastline (10%). The maximum entrained oil concentration is forecast as 156,954 ppb within the Montebello Marine Park.
- Dissolved aromatic hydrocarbons at concentrations equal to or greater than the 50 ppb threshold are predicted to be found up to around 216 km from the spill site. Barrow Island (probability 1%), Montebello Islands (probability 1%), Rankin Bank (probability 1%), Montebello Marine Park (probability 49%), Montebello State Marine Park (probability 1%) and the WA Coastline (probability 1%) are receptors predicted to receive dissolved aromatic hydrocarbon concentrations at the 50 ppb threshold. The maximum dissolved aromatic hydrocarbon concentration is forecast as 1990 ppb within the Montebello Marine Park.
- Accumulated hydrocarbons above threshold concentrations (≥100 g/m^2) were not predicted by the modelling to occur.

CS-03 (In Scarborough field (FPU location)):

- Surface hydrocarbons equal to or greater than the 10 g/m^2 threshold could potentially be found up to 113 km from the spill site. No shoreline receptors are predicted to be contacted by surface hydrocarbons concentrations. Floating oil at the 10 g/m^2 threshold is predicted to arrive at the surface waters of the Gascoyne Marine Park receptor with a probability of 1% after 64 hours.

- Entrained oil at concentrations equal to or greater than the 100 ppb threshold is predicted to be found up to around 918 km from the spill site. The Gascoyne Marine Park, Carnarvon Canyon Marine Park and Abrolhos Islands Marine Park receptors are predicted to receive entrained oil concentrations at the 100 ppb threshold with a probability of 10%, 1% and 1%, respectively. The maximum entrained oil concentration is forecast as 7236 ppb within the Gascoyne Marine Park.
- Dissolved aromatic hydrocarbons at concentrations equal to or greater than the 50 ppb threshold are predicted to be found up to around 244 km from the spill site. The Gascoyne Marine Park is the only receptor predicted to receive dissolved aromatic hydrocarbon concentrations at the 50 ppb threshold with a probability of 3%. The maximum dissolved aromatic hydrocarbon concentration is forecast as 462 ppb within the Gascoyne Marine Park.
- Accumulated hydrocarbons above threshold concentrations (≥100 g/m²) were not predicted by the modelling to occur.

3 IDENTIFY RESPONSE PROTECTION AREAS (RPAs)

In a response, operational monitoring programs – including trajectory modelling and vessel/aerial observations – would be used to predict RPAs that may be impacted. For the purposes of planning and appropriately scaling a response, modelling has been used to identify RPAs as outlined below in **Figure 3-1**.

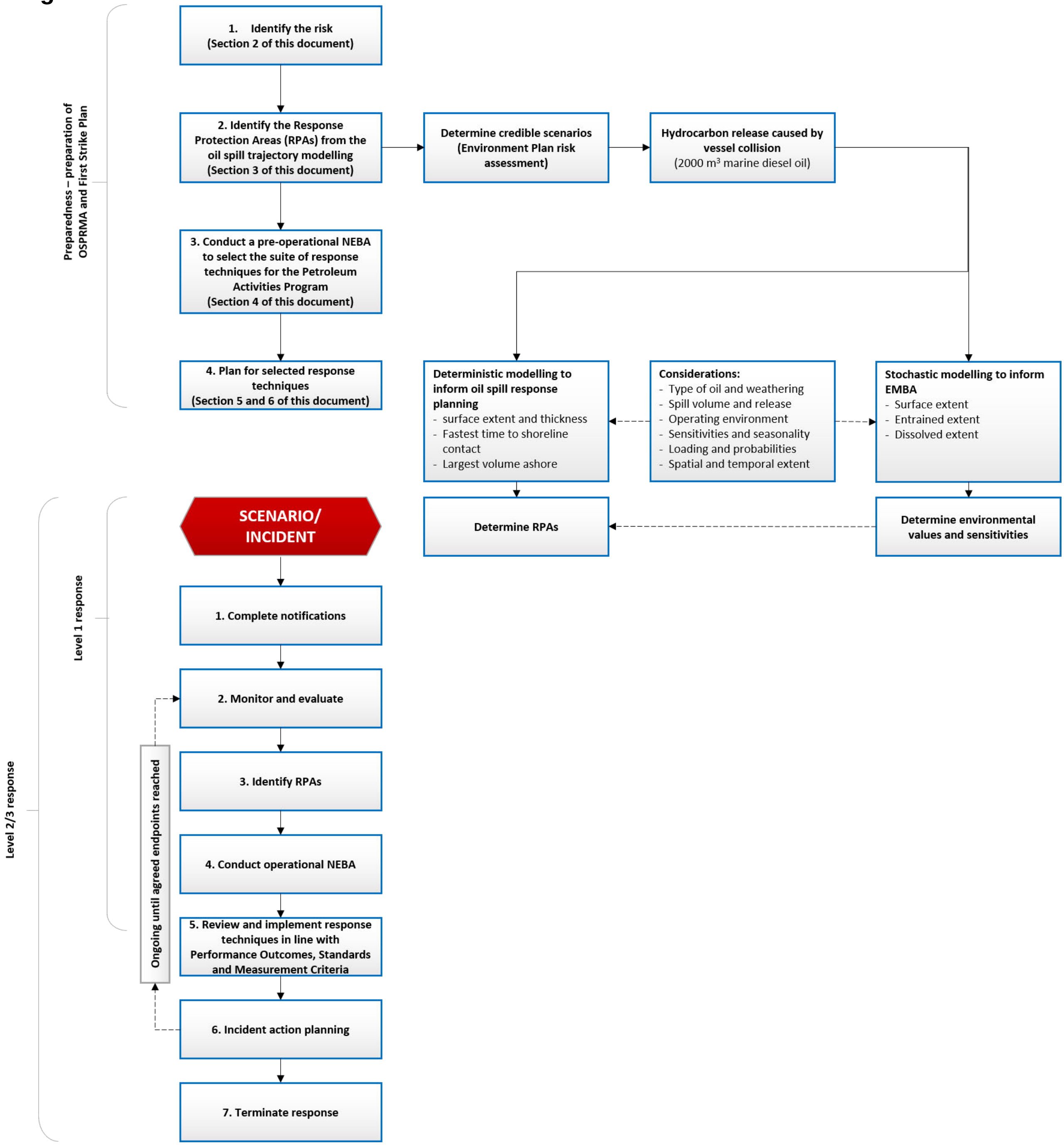

Figure 3-1: Identify Response Protection Areas (RPAs) flowchart

3.1 Identified sensitive receptor locations

Section 6 of the EP includes sensitive receptor locations 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 (RPAs)

From the identified sensitive receptors described in Section 6 of the EP, only those for 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[5]) have been selected for response planning purposes.

3.2.1 Response Protection Areas (RPAs)

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**). It is important to note that the RPAs are determined from the combined results of the individual worst-case runs and do not indicate a single worst case credible scenario (where the timings and volumes are all expected from one release).

The only RPA identified for the PAP is the Dampier Archipelago.

During a spill event, operational monitoring (OM) techniques (OM01, OM02, OM03, OM04 and OM05) would be deployed from the outset of the spill to track the spill trajectory and deduce if any RPAs are at risk of impact. TRPs will be drafted in advance for any RPAs with a contact time of <14 days.

Any additional sensitive receptors are presented in the existing environment description (Section 4 of the EP) and impact assessment section (Section 6 of the EP) for the spill scenario. The pre-operational NEBA (**Section 4**) considers the results from the stochastic modelling to ensure all feasible response techniques are considered in the planning phase, therefore additional receptors are also included in the pre-operational NEBA.

[5] Operational monitoring will be undertaken from the outset of a spill whether or not this threshold has been reached. Monitoring is needed throughout the response to assess the nature of the spill, track its location and inform the need for any additional monitoring and/or response techniques. It also informs when the spill has entered State Waters and/or control of the incident passes to statutory authorities e.g. WA DoT or AMSA.

Table 3-1: Response Protection Areas (RPAs)

			CS-01		CS-02		CS-03	
Areas of coastline contacted	**Conservation status**	**IUCN protection category**	**Minimum time to shoreline contact (above 10 g/m^2) in days (6)**	**Maximum shoreline accumulation (above 10 g/m^2) in m^3 (7)**	**Minimum time to shoreline contact (above 10 g/m^2) in days (5)**	**Maximum shoreline accumulation (above 10 g/m^2) in m^3 (6)**	**Minimum time to shoreline contact (above 10 g/m^2) in days (5)**	**Maximum shoreline accumulation (above 10 g/m^2) in m^3 (6)**
Dampier Archipelago	National Heritage Property	N/A	2.2 days	3 m^3	No shoreline contact above threshold predicted	No shoreline contact above threshold predicted	No shoreline contact above threshold predicted	No shoreline contact above threshold predicted

[6] This volume and time represent the first time to contact on defined shoreline polygon and the maximum volume ashore for that 24 hour period.
[7] This volume and time represent the maximum volume ashore on defined shoreline polygon for any 24 hour time period

4 NET ENVIRONMENTAL BENEFIT ANALYSIS (NEBA)

A Net Environmental Benefit Analysis (NEBA) is a structured process to consider which response techniques are likely to provide the greatest net environmental benefit. The NEBA process typically involves four key steps outlined in **Figure 4-1**: evaluate data, predict outcomes, balance trade-offs, and select response options. These steps are followed in the planning/preparedness process and would also be followed in a response.

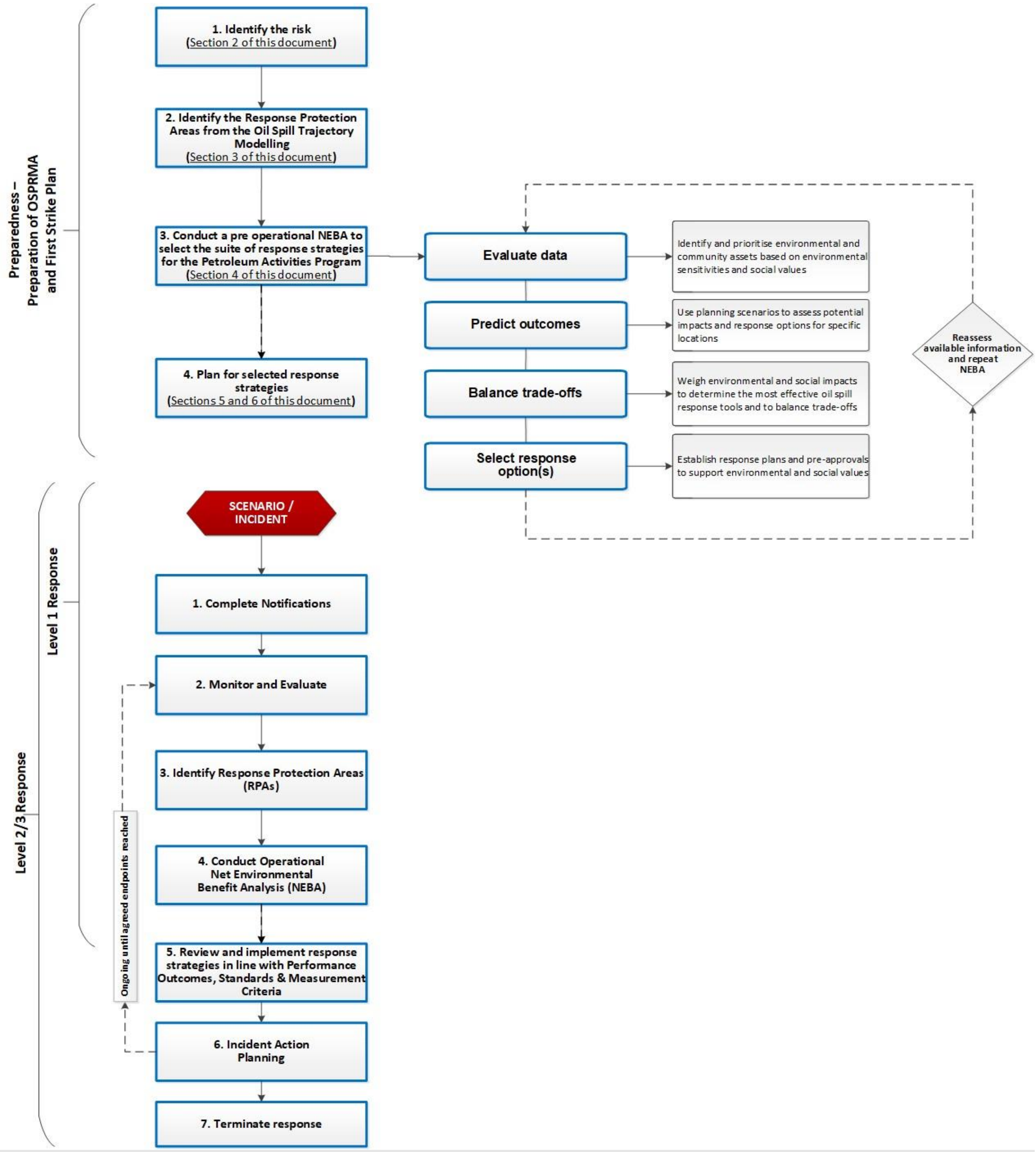

Figure 4-1: Net Environmental Benefit Analysis (NEBA) flowchart

4.1 Pre-operational / Strategic NEBA

The pre-operational NEBA identifies positive and negative impacts to sensitive receptors from implementing the response techniques. Feasibility is considered by assessing the receptors potentially impacted above response thresholds (**Section 2.3.3**) and the surface concentrations (**Section 2.3.4**) from the deterministic modelling.

Completing a pre-operational NEBA is a key response planning control that reduces the environmental risks and impacts of implementing the selected response techniques. The pre-operational NEBA for this PAP is 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 deterministic modelling and is used for this pre-operational NEBA. Outlier locations with potential environmental impacts, selected from the stochastic modelling may also be included for assessment. Response thresholds and deterministic modelling are then used to assess the feasibility/effectiveness and scale of the response.

Table 4-1: Scenario summary information (WCCS, CS-01, CS-02 and CS-03)

Scenario summary information	
Scenario	Surface release of vessel fuel tank due to a vessel collision
Locations	CS-01: 20° 21' 3.28" S, 116° 42' 5.58" E (outside Mermaid Sound)
	CS-02: 20° 03' 1.44" S, 115° 31' 35.04" E (within Montebello MP)
	CS-03: 19° 53' 54.72" S, 113° 14' 19.56" E (in Scarborough Field, FPU location)
Oil Type	Marine Diesel
Fate and Weathering	Refer to **Section 2.2.1**
Volume and duration of release	2000 m^3 instantaneous

4.2.1.1 Hydrocarbon characteristics

Marine Diesel

Marine Diesel 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. Under constant 5 kn wind conditions, about 6% of the oil mass is predicted to 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%. Under variable wind conditions where winds are of a greater strength, more entrainment of oil into the water column is predicted (about 45% after 24 hours). A further 35% is forecast to evaporate, leaving only a small proportion of the oil floating on the water surface (<1%).

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.

Table 4-2: Oil fate, behaviour and impacts

Deterministic modelling results (CS-01 – outside Mermaid Sound)	
Minimum time to shoreline contact (above 100 g/m^2)	53 hours (2.2 days) at the Dampier Archipelago
Largest volume ashore at any single RPA (above 100 g/m^2)	3 m^3 at the Dampier Archipelago
Largest total shoreline accumulation (above 100 g/m^2)	156 g/m^2 at the Dampier Archipelago
Stochastic modelling results (CS-02 – within Montebello MP)	
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 (CS-03 – Scarborough field, FPU location)	
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 (via vessel SOPEP)
- Containment and recovery
- In situ burning
- 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**. These options were evaluated against each scenario's parameters including oil type, volume and characteristics, prevailing weather conditions, logistical support, and resource availability to determine their deployment feasibility.

A shortlist of the feasible response options is then carried forward for the ALARP assessment with a justification for the exclusion of other response techniques included in **Section 4.2.3**. This assessment will typically result in a range of available options, that are deployed at different areas (at-source, offshore, nearshore and onshore) and times through the response. The NEBA process assists in prioritising which options to use where and when and timings throughout the response.

Table 4-3: Response technique evaluation – Surface Release

Response Technique	Effectiveness	Feasibility	Decision	Rationale for the decision
Hydrocarbon: Marine Diesel				
Monitor and Evaluate	Will be effective in tracking the location of the spill, predicting potential impacts and triggering further monitoring and response techniques as required. Operational monitoring (OM) techniques include: • OM01 Predictive modelling of hydrocarbons – used throughout release. 'Ground-truthed' using the outputs of all other monitoring techniques. • OM02 Surveillance and reconnaissance to detect hydrocarbons and resources at risk – from outset of release. • OM03 Monitoring of hydrocarbon presence, properties, behaviour and weathering in water – from outset of release. • 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 diesel release is a feasible response technique and outputs can be used to guide decision making on the use of other response techniques and providing information to regulatory agencies including AMSA and Western Australia's Department of Transport (WA DoT).	**Yes**	Monitoring the release will be necessary to: • Validate trajectory and weathering models • Determine the behaviour of the oil in water • Determine the location and weathering condition of the slick • Provide forecasts of spill trajectory • Determine appropriate response techniques • Determine effectiveness of response techniques • Confirm impact pathways to receptors
Source Control (via vessel SOPEP)	Controlling the spill of diesel at source would be the most effective way to limit the quantity of hydrocarbon entering the marine environment.	A spill of diesel from a vessel collision will be instantaneous and source control will be limited to what the vessel or facility can 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 diesel. The dispersant droplets tend to pass through the surface films without binding to the hydrocarbon.	Marine diesel has a high portion of non-persistent (light-ends) component and is prone to rapid spreading and evaporation thus the use of dispersant would be deemed an unnecessary response technique. Furthermore, the volatile nature of Marine Diesel is also likely to lead to unsafe conditions in the vicinity of fresh hydrocarbon thus this response technique is deemed inappropriate.	**No**	The application of dispersant to marine diesel is unnecessary as the diesel will rapidly evaporate and would thus unnecessarily introduce additional chemical substances to the marine environment. The additional entrainment would also increase exposure of subsea species and habitats to hydrocarbons.
Containment and Recovery	Containment and recovery have an effective recovery rate of 5-10% when a hydrocarbon encounter rate of 25-50% is achieved at BAOAC 4 and 5. Containment and recovery requires a spill to be BAOAC 4 or 5 with a 50-100% coverage at a thickness of 100 g/m^2 (or 0.1 mm) to 200 g/m^2.	The rate at which diesel would spread in the warm waters off the North West Shelf mean that this strategy would not be feasible. Furthermore, the volatile nature of Marine Diesel is also likely to lead to unsafe conditions in the vicinity of fresh hydrocarbon thus this response technique is deemed inappropriate.	**No**	Containment and recovery would be an inappropriate response technique as the coverage requirements would not be achieved by a marine diesel spill. In addition, most of the spilled diesel would have been subject to rapid evaporation and entrainment prior to the commencement of containment and recovery operations.
In situ Burning	In situ burning is only effective where minimum slick thickness can be achieved.	Use of in situ burning as a response technique for marine diesel is unfeasible as the minimum slick thickness cannot be attained due to rapid spreading. In addition, there is a limited window of opportunity in which this technique can be applied (prior to evaporation of the volatiles) which is unlikely to be achieved. Furthermore, entering a volatile environment to undertake this technique would be unsafe for response personnel.	**No**	Diesel characteristics are not appropriate for the use of in situ burning as the minimum thickness will not be attained due to rapid spreading. Furthermore, it would unnecessarily cause an increase in the release of atmospheric pollutants.

Response Technique	Effectiveness	Feasibility	Decision	Rationale for the decision
Hydrocarbon: Marine Diesel				
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. Additionally, any vessel used for mechanical dispersion activities would be contaminated by the hydrocarbon and could potentially cause secondary contamination of unimpacted areas when exiting the spill area. The decontamination of a vessel used for mechanical dispersion activities would result in additional quantities of oily waste requiring appropriate handling and treatment.	**No**	Given the limited benefit of mechanical dispersion over natural wind and wave action, secondary contamination and waste issues, and the associated safety risk of implementing the response for this activity, this strategy is deemed unsuitable.
Shoreline Protection and Deflection	This strategy is deployed at highly sensitive sites to prevent ingress of hydrocarbon or to increase concentrations in an area more suitable for shoreline clean-up.	Given the minimum time to shoreline contact is 2.2 days, use of shoreline protection and deflection for a spill of marine diesel may provide some environmental benefit and could prevent shoreline accumulation occurring (although maximum concentration of shoreline loading is predicted to be 3 m^3). Operational monitoring will 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.	**Yes**	Protection and deflection may be deployed to prevent contamination of sensitive resources. RPAs predicted to be contacted are based on modelling outputs and thus may differ under the prevailing conditions of a real event, as the locations of oiling and the volume ashore may vary.
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.	Potential for accumulation of oil on shorelines is predicted to be low. This strategy can reduce or prevent impact on sensitive receptors and helps prevent remobilisation of hydrocarbons. Although the concentrations are lower than optimal some shoreline clean-up may be possible at natural collection points on the coastline.	**Yes**	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. Low concentrations for manual clean up however there may be isolated higher concentrations in sheltered areas that could be manually recovered
Oiled Wildlife	Oiled wildlife response is an effective response technique for reducing the overall impact of a release on wildlife. This is mostly achieved through hazing to prevent additional fauna from being contaminated and through rehabilitation of fauna already subject to contamination. Air-breathing fauna such as marine mammals are most at risk from surface exposures due to the high volatile components. Marine mammals that have direct physical contact with surface, entrained or dissolved aromatic hydrocarbons may suffer surface fouling, ingest hydrocarbons and inhale toxic vapours.	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**	In the event that wildlife are at risk of contamination, oiled wildlife response will be undertaken as and where required.

4.2.3 Exclusion of response techniques

Response techniques that are not feasible for the worst case scenario for the PAP are detailed in the subsections below and are excluded from further assessment within this document.

4.2.3.1 Containment and recovery

Marine diesel is prone to rapid spreading and evaporation thus reducing the feasibility of containment and recovery as a response technique. Furthermore, entering a volatile environment to undertake this technique would be unsafe for response personnel. Although this scenario results in surface oil of BAOAC 4, this only occurs within the first few hours during which time volatile levels would be very high and unsafe for response personnel.

4.2.3.2 Surface dispersant application

Marine diesel is prone to rapid spreading and evaporation thus the use of dispersant would be deemed an unnecessary response technique. 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.

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. The volatile nature of the oil is likely to lead to unsafe conditions in the vicinity of fresh hydrocarbon. There are also secondary contamination and waste issues to consider.

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 offshore waters of the Operational Area. Optimum weather conditions are <20 knot wind speed and waves <1 to 1.5 m with oil collected to a minimum 3mm thick layer. Due to the conditions in Operational Area 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. Furthermore, it is unlikely that MDO would achieve the required thickness for in situ burning, rendering this an unsuitable method.

Until further operational and environmental information becomes available, Woodside will not consider this option.

4.3 Stage 2: Predict outcomes

Woodside uses planning scenarios to assess potential impacts and response options for specific locations. Locations with potential environmental impacts, selected from the stochastic modelling are included for assessment. Response thresholds and deterministic modelling are then used to assess the feasibility/effectiveness of a response.

4.4 Stage 3: Balance trade-offs

Woodside considers environmental impacts and response effectiveness/feasibility to determine the most effective oil spill response tools and balance trade-offs, using an automated NEBA tool. The tool considers potential benefits and impacts associated with a response at sensitive receptors and then considers the effectiveness/feasibility of the response to select the response techniques carried forward to the ALARP assessment. 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 the selected response options are outlined in **Section 7**.

Table 4-4: Selection and prioritisation of response techniques

Response planning scenario	Key characteristics for response planning	Feasibility of response techniques									Outline response technique
		Monitor and evaluate	Source control via vessel SOPEP	Surface dispersant application	Mechanical dispersion	In situ burning	Containment and recovery	Shoreline protection and deflection	Shoreline clean-up	Oiled wildlife response	
Release of up to 2000 m^3 marine diesel from a vessel collision (residual component of 100 m^3)	The shortest timeframe that shoreline contact from floating oil is predicted at >100 g/m is 2.2 days at Dampier Archipelago with shoreline accumulation peaking at approximately 3 m^3. Other islands, banks, shoals and mainland locations may be exposed to entrained hydrocarbons.	**Yes**	**Yes**	**No**	**No**	**No**	**No**	**Yes**	**Yes**	**Yes**	• Monitor and evaluate. • Initiate vessel source control if safe and feasible. • If operational monitoring activities indicate surface hydrocarbons in sufficient concentration are moving toward shorelines, the Protection and Deflection Operational Plan will be used. • 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. • 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
- Source control – vessel SOPEP
- Shoreline protection and deflection
- Shoreline clean-up
- Oiled wildlife response

Additional response strategies would be considered based on the inputs and field reports from the monitoring activities. This may include:

- Waste management
- Scientific monitoring programs

5 HYDROCARBON SPILL ALARP PROCESS

Woodside's hydrocarbon spill ALARP process is aligned with guidance provided by NOPSEMA in *Guidance Note GN1488* (2021) 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, and
   - 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 deterministic modelling.

For the purpose of the ALARP assessment, the following terms and definitions have been used:

- Response techniques are considered the control measures that reduce consequences from hydrocarbon spill events. The terms 'response technique' and 'control measure' are used interchangeably.
- Cost is defined as the time, effort and/or trouble taken in financial, safety, design/storage/installation, capital/lease, and/or operations/maintenance terms to adopt a control measure.
- Where the predicted change to environmental impact is compared against standard environmental values and sensitivities impacts using positive or negative criteria from the NEBA Impact Ranking Classification Guidance in Annex A.

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 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 multiple logistical options are available to monitor the spill in relatively short timeframes. The primary mobilisation base for initial monitoring activities would be Exmouth. However, in the 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:

- The shortest timeframe for shoreline contact from floating oil is predicted to be 2.2 days at Dampier Archipelago.
- Entrained hydrocarbon concentrations greater than 100 ppb may occur at numerous locations, including islands, banks, shoals or mainland locations, between 1 hour and 34 days following the release.
- 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

<table>
<tr><th colspan="2">Environmental Performance Outcome</th><td colspan="3">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.</td></tr>
<tr><th colspan="2">Control measure</th><th colspan="2">Performance Standard</th><th>Measurement Criteria (Section 5.9)</th></tr>
<tr><td rowspan="3">1</td><td rowspan="3">Oil spill trajectory modelling</td><td>1.1</td><td>Initial modelling available within 6 hours using the Rapid Assessment Tool</td><td rowspan="3">1, 3B, 3C, 4</td></tr>
<tr><td>1.2</td><td>Detailed modelling available within 4 hours of RPS receiving information from Woodside</td></tr>
<tr><td>1.3</td><td>Detailed modelling service available for the duration of the incident upon contract activation</td></tr>
<tr><td rowspan="4">2</td><td rowspan="4">Tracking buoy</td><td>2.1</td><td>Tracking buoy located on facility/vessel and ready for deployment 24/7</td><td>1, 3A, 3C, 4</td></tr>
<tr><td>2.2</td><td>Deploy tracking buoy from facility within 2 hours as per the First Strike Plan.</td><td>1, 3A, 3B, 4</td></tr>
<tr><td>2.3</td><td>Contract in place with service provider to allow data from tracking buoy to be received 24/7 and processed.</td><td>1, 3B, 3C, 4</td></tr>
<tr><td>2.4</td><td>Data received to be uploaded into Woodside common operating picture (COP) daily to improve the accuracy of other monitor and evaluate techniques.</td><td>1, 3B, 4</td></tr>
<tr><td rowspan="6">3</td><td rowspan="6">Satellite imagery</td><td>3.1</td><td>Contract in place with 3rd party provider to enable access and analysis of satellite imagery. Imagery source/type requested on activation of service.</td><td>1, 3C, 4</td></tr>
<tr><td>3.2</td><td>3rd party provider will confirm availability of an initial acquisition within 2 hours</td><td>1, 3B, 3C, 4</td></tr>
<tr><td>3.3</td><td>First image received with 24 hours of Woodside confirming to 3rd party provider its acceptance of the proposed acquisition plan.</td><td>1</td></tr>
<tr><td>3.4</td><td>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.</td><td>1</td></tr>
<tr><td>3.5</td><td>Data received to be uploaded into Woodside COP daily to improve accuracy of other monitor and evaluate techniques.</td><td>1, 3B, 4</td></tr>
<tr><td>3.6</td><td>Satellite Imagery services available and employed during response</td><td>1, 3C, 4</td></tr>
<tr><td rowspan="4">4</td><td rowspan="4">Aerial surveillance</td><td>4.1</td><td>2 trained aerial observers available to be deployed by day 1 from resource pool.</td><td>1, 2, 3B, 3C, 4</td></tr>
<tr><td>4.2</td><td>1 aircraft available for two sorties per day, available for the duration of the response from day 1</td><td>1, 3C, 4</td></tr>
<tr><td>4.3</td><td>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.</td><td>1, 2, 3B, 4</td></tr>
<tr><td>4.4</td><td>Unmanned Aerial Vehicles/Systems (UAV/UASs) to support SCAT and pre-emptive assessments as contingency if required.</td><td>1, 2</td></tr>
<tr><td rowspan="5">5</td><td rowspan="5">Hydrocarbon detections in water</td><td>5.1</td><td>Activate 3rd party service provider as per first strike plan. Deploy resources within 2.5 days:
• 3 specialists in water quality monitoring
• 2 monitoring systems and ancillaries
• 1 vessel for deploying the monitoring systems with a dedicated winch, A-frame or Hiab and ancillaries to deploy the equipment.</td><td>1, 2, 3C, 3D, 4</td></tr>
<tr><td>5.2</td><td>Water monitoring services available and employed during response</td><td rowspan="3">1, 3C, 4</td></tr>
<tr><td>5.3</td><td>Preliminary results of water sample as per contractor's implementation plan within 7 days of receipt of samples at the accredited lab</td></tr>
<tr><td>5.4</td><td>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.</td></tr>
<tr><td>5.5</td><td>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.</td><td>1, 2, 3C, 4</td></tr>
<tr><td>6</td><td>Pre-emptive assessment</td><td>6.1</td><td>Within 2 days, deployment of 2 specialists from resource pool in establishing the status of sensitive receptors.</td><td>1, 2, 3B, 3C, 4</td></tr>
</table>

	of sensitive receptors	6.2	Daily reports provided to IMT on the status of the receptors to prioritise Response Protection Areas (RPAs) and maximise effective utilisation of resources.	1, 3B, 4
7	Shoreline assessment	7.1	Within 2 days, deployment of 2 specialists in SCAT from resource pool for each of the Response Protection Areas (RPAs) with predicted impacts at greater than 100 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
		7.3	Shoreline access routes with the least environmental impact identified will be selected by a specialist in SCAT operations.	1
8	Management of environmental impact of the response risks	8.1	If vessels are required for access, anchoring locations will be selected to minimise disturbance to benthic habitats. Where existing fixed anchoring points are not available, locations will be selected to minimise impact to nearshore benthic environments with a preference for areas of sandy seabed where they can be identified.	1

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**.
- 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.

5.2 Source Control via Vessel SOPEP

Vessel source control will be conducted, where feasible and in accordance with International Convention for the Prevention of Pollution from Ships (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 International Marine Organisation (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 a potential vessel collision, the vessel master may engage precautionary marine manoeuvres to avoid collision or commence pumping operations to transfer marine diesel and thus minimise the release.

5.2.1 Environmental performance based on need

Woodside has established control measures, environmental performance outcomes, performance standards and measurement criteria to be used for vessel-source oil spill response during the PAP which are detailed in Section 6.7 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.

5.3 Shoreline protection and deflection

The placement of containment, protection or deflection booms on and near a shoreline is a response technique to reduce the potential volume of hydrocarbons contacting or spreading along shorelines, which may reduce the scale of shoreline clean-up. Hydrocarbons contained by the booms would be collected where practicable.

Shorelines would be protected where accessible via vessel or shore. Where hydrocarbon contact has already occurred, there may still be value in deploying protection equipment to limit further accumulations and preventing remobilisation of stranded hydrocarbons.

Shoreline protection and deflection equipment would be mobilised to selected locations, where the following conditions were met:

- Sea-states and hydrocarbon characteristics are safe to deploy protection and deflection measures,
- Oil trajectory has been identified as heading towards identified RPAs.

5.3.1 Response need based on predicted consequence parameters

The following statements identify the key parameters upon which the response need can be based.

- Floating oil at the 10 g/m^2 threshold is predicted to arrive at the Dampier Archipelago with a probability of 2% after 27 hours (CS-01).
- Shoreline accumulation greater than the 100 g/m^2 threshold is predicted to occur at Dampier Archipelago after a minimum of 2.2 days with a maximum shoreline accumulation of 156 g/m^2 (CS-01).
- Pre-emptive assessment and shoreline assessments (OM04 and OM05) will be mobilised prior to shoreline accumulation at 100 g/m^2.
- Following pre-emptive assessments of sensitive receptors at risk, and in agreement of prioritisation with WA DoT (if a Level 2/3 incident and within State Waters), protection and deflection operations would commence until agreed termination criteria are reached.
- Shoreline response operations may extend 1-2 weeks following the release based on the predicted time for shoreline contact and the time to complete shoreline clean-up operations.
- Arrangements for support organisations who provide specialist services (trained personnel, protection and deflection 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 need to be 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 Protection and Deflection. These assumptions have been described in the table below.

Table 5-3: Response Planning Assumptions – Shoreline Protection and Deflection

Response Planning Assumptions	
Safety considerations	Shoreline protection and deflection 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. Personnel safety issues may include: • hydrocarbon gas and/or liquid exposure • safe for deployment and conditions within range of vessels • high ambient temperatures.

Shoreline Protection and Deflection	One (1) Shoreline Protection and Deflection operation may include; • Quantity of shoreline sealing boom (as outlined in TRP) • Quantity of fence or curtain boom (as outlined in TRP) • 1-2 x trained supervisors • 8-10 x personnel / labour hire Specific details of each operation would be tailored to the Tactical Response Plan implemented (where available).

5.3.2 Environmental performance based on need

Table 5-4: Environmental Performance – Shoreline Protection and Deflection

Environmental Performance Outcome		To stop hydrocarbons encountering particularly sensitive areas		
Control measure		**Performance Standard**		**Measurement Criteria (Section 5.9)**
9	Response teams	9.1	Relevant Tactical Response Plans (TRPs) will be identified in the first strike plan for activation within 12 hours of the release.	1, 3A, 3C, 4
		9.2	In liaison with WA DoT (for Level 2/3 incidents), mobilise teams to RPAs within 12 hours of operational monitoring predicting impacts. Teams to contaminated RPAs comprised of: • 1-2 trained specialists per operation • 8-10 personnel/labour hire Personnel sourced through resource pool	1, 2, 3B, 3C, 4
		9.3	One operation mobilised within 24 hours to each identified RPA. Expected to be one RPAs within two days (operation as detailed above)	1, 3A, 3B, 4
		9.4	12 trained personnel available within 48 hours sourced through resource pool.	1, 2, 3A, 3B, 3C, 4
		9.5	Open communication line to be maintained between IMT and infield operations to ensure awareness of progress against plan(s)	1, 3A, 3B
		9.6	The safety of shoreline response operations will be considered and appropriately managed. During shoreline 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
10	Response equipment	10.1	Equipment mobilised from closest stockpile within 12 hours.	1, 3A, 3C, 4
		10.2	Supplementary equipment mobilised from State, AMOSC, AMSA stockpiles within 24 hours.	1, 3C, 3D, 4
		10.3	Supplementary equipment mobilised from OSRL within 48 hours.	
		10.4	Woodside maintains integrated fleet of vessels. Additional vessels can be sourced through existing contracts/frame agreements	1, 3A, 3C, 4
11	Management of Environmental Impact of the response risks	11.1	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
		11.2	Shallow draft vessels will be used to access remote shorelines to minimise the impacts associated with seabed disturbance on approach to the shorelines	

The resulting shoreline protection and deflection capability has been assessed against the WCCS. The range of techniques provide an ongoing approach to shoreline protection and deflection at identified RPAs.

Under optimal conditions, during the subsea and surface releases the capability available exceeds the need identified. It indicates that, the shoreline protection and deflection capability have the following expected performance:

- Deterministic modelling scenarios indicate that first shoreline impact at Dampier Archipelago may occur within 2.2 days for CS-01.
- Existing capability allows for mobilization and deployment of 1 protection and deflection operation (approximately 10-12 responders) within 24 hours (if required). The existing capability is considered sufficient to mobilise and deploy protection at RPAs prior to hydrocarbon contact, guided by the ongoing operational monitoring.

- 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 Port Hedland, and the management of response generated waste. From previous assessment of accommodation in this region, Woodside estimates that current accommodation can cater for a range of 500-700 personnel per day for an ongoing operation.
- TRPs have been developed for all identified RPAs excepting international locations.
- 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 as the timeframe required for deployment of this technique does not justify the excessive costs of identified alternate, improved or additional controls.

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 Cleanup 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 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

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	<u>**Surface Threshold**</u>
	• 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)

- The shortest timeframe that shoreline contact from floating oil is predicted is 2.2 days at Dampier Archipelago with shoreline accumulation peaking at approximately 3 m^3.
- 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 5-6: 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.	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).

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.

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 and reduce oiled waste before contact. 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.

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 (Section 5.9)**
12	Shoreline responders	12.1	In liaison with WA DoT (for Level 2/3 incidents), deployment of one shoreline clean-up team to each contaminated RPA 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
		12.2	Relevant Tactical Response Plans (TRPs) will be identified in the first strike plan for activation within 12 hours of the release	1, 3A, 3C, 4
		12.3	Clean-up operations for shorelines in line with results and recommendations from SCAT outputs	1, 3A, 3B
		12.4	All shoreline clean-up sites will be zoned and marked before clean-up operations commence.	
		12.5	In liaison with WA DoT (for Level 2/3 incidents), mobilise and deploy one shoreline clean-up operation where operational monitoring predicts accumulations >100 g/m^2 by Day 2.	1, 2, 3A, 3C, 4
		12.6	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
		12.7	Open communication line to be maintained between IMT and infield operations to ensure awareness of progress against plan(s)	1, 3A, 3B
13	Shoreline clean-up equipment	13.1	Contract in place with 3rd party providers to access equipment.	1, 3A, 3C, 4
		13.2	Equipment mobilised from closest stockpile within 24 hours.	
		13.3	Supplementary equipment mobilised from State, AMOSC, AMSA stockpiles within 2 days, if required.	1, 3C, 3D, 4
		13.4	Supplementary equipment mobilised from OSRL within 5 days, if required.	
14	Management of Environmental Impact of the response risks	14.1	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
		14.2	Shallow draft vessels will be used to access remote shorelines to minimise the impacts associated with seabed disturbance on approach to the shorelines	
		14.3	Vehicular access will be restricted on dunes, turtle nesting beaches and in mangroves	
		14.4	Removal of vegetation will be limited to moderately or heavily oiled vegetation	
		14.5	Shoreline access routes with the least environmental impact identified will be selected by a specialist in SCAT operations	
		14.6	Oversight by trained personnel who are aware of the risks	
		14.7	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. Woodside's capability can cover all required shoreline clean-up operations for the PAP. Whilst modelling predicts shoreline contact from day 2 at Dampier Archipelago 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 1-2 shoreline clean-up teams (approx. 10-20 responders) by Day 2 using existing labour hire contracts with Woodside, AMOSC, Core Group, AMSA, WA DoT and OSRL team leads.
- 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 indicates that for a worst-case scenario the actual teams required would meet the available capability.
- 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 accommodation and transport of personnel in Exmouth and management of response generated waste. From previous assessment of accommodation in Exmouth, Woodside estimates that current accommodation can cater for a range of 500-700 personnel per day for an ongoing operation, which exceeds the number of personnel that would be required.
- TRPs have been developed for all identified RPAs.
- 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 as the limited scale and timeframe for deployment of this technique does not justify the excessive costs of identified alternate, improved or additional controls.

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 Western Australia Department of Biodiversity, Conservation and Attractions (DBCA).

Oiled wildlife response is undertaken in accordance with the (WA OWRP) 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 (WA OWRP), 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. Vehicle access would be restricted on dunes, turtle nesting beaches and in mangroves. Woodside retains specialist personnel to support and manage oiled wildlife operations, including trained and competent responders in Exmouth or the wider region. 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:

- Modelling predicts the shortest time to shoreline contact at day 2 at Dampier Archipelago.
- The offshore location of the release site is expected to initially result in low numbers of at-risk or impacted wildlife.
- As the surface oil approaches shorelines, potential for oiled wildlife impacts are likely to increase.
- It is estimated that an oiled wildlife response would be between Level 2 and 3, as defined in the WA OWRP.

Table 5-8: Key at-risk species potentially in Priority Protection Areas and open ocean

Species	Open ocean	Dampier Archipelago	Montebello AMP	Gascoyne AMP	Dampier AMP
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. 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/or Onslow have been identified in the draft Regional Oiled Wildlife Response Operational Plan (OWROP), should a land-based site be required.
Stage 7: Wildlife rehabilitation	Considerations include a suitable rehabilitation centre and personnel, wildlife housing, record keeping and success tracking.
Stage 8: Oiled wildlife response termination	Once a decision has been made to terminate operations, the Incident Controller will stand down individual participating and supporting agencies.

Reconnaissance and primary response would be done during operational monitoring and surveillance activities. Where marine fauna is 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/or 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 & 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.

Table 5-10: Indicative oiled wildlife response (OWR) 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

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 Western Australian Oiled Wildlife Response Plan (WAOWRP) 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 (Section 5.9)**
15	Wildlife response equipment	15.1	Contracted capability to treat 100 individual fauna for immediate mobilisation to Response Priority Areas (RPAs)	1, 3A, 3B, 3C, 4
		15.2	Contracted capability to treat up to an additional 250 individual fauna within a five-day period.	
		15.3	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
		15.4	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
		15.5	Facilities for the rehabilitation of oiled wildlife are operational 24/7 as per WAOWRP.	1, 3A, 4
16	Wildlife responders	16.1	2 OWR Team Members to lead the oiled wildlife operations who have completed an Oiled Wildlife Response Management course	1, 2, 3B
		16.2	Wildlife responders to be accessed through resource pool and additional agreements with specialist providers	1, 2, 3A, 3B, 3C, 4
		16.3	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	1
		16.4	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.

Wildlife collection operations would be expected to peak between Day 3 and Day 14 and decrease thereafter. 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.

Under optimal conditions, during the 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 1-2 wildlife collection teams within the first 5 days of the incident
- Mobilisation and deployment of 1-2 central wildlife treatment and rehabilitation locations at Exmouth and/or Onslow in accordance with WA OWRP.

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 and/or Onslow.

5.6 Waste Management

Waste management is considered a support technique to wildlife response 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 shoreline clean-up and wildlife response; and/or
- Solids/semi-solids (oily solids, garbage, contaminated materials) and debris (e.g. seaweed, sand, woods, and plastics) collected during shoreline clean-up and wildlife response.

Expected waste volumes during an event are likely to vary depending on oil type, volume released, response techniques employed and how weathering of hydrocarbons. Waste management, handling and capacity should be scalable to ensure continuous response operations can be maintained.

All waste management activities will follow the Environment Protection (Controlled Waste) Regulations 2004 and the waste will be managed to minimise final disposal volumes. Waste treatment techniques will consider contaminated solids treatment to allow disposal to landfill and solids with high concentrations of hydrocarbon will be treated and recycled where possible or used in clean fill if suitable.

The waste products would be transported from response locations to the nearest suitable staging area/waste transfer station for treatment, disposal or recycling. Waste will be transferred with appropriately licensed vehicles. Containers will be available for temporary waste storage and will be:

- labelled with the waste type
- provided with appropriate lids to prevent waste being blown overboard
- bunded if storing liquid wastes.
- processes will be in place for transfers of bulk liquid wastes and include:
  - inspection of transfer hose undertaken prior to transfer
  - watchman equipped with radio visually monitors loading hose during transfer
  - tank gauges monitored throughout operation to prevent overflow

The Oil Spill Preparedness Waste Management Support Plan details the procedures, capability and capacity in place between Woodside and its primary waste services contractor (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)	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

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 (Section 5.9)**
17	Waste Management	17.1	Contract with waste management services for transport, removal, treatment and disposal of waste	1, 3A, 3B, 3C, 4
		17.2	Access to at least 213 m^3 of solid and liquid waste storage available within 2 days upon activation of 3rd party contract.	
		17.3	Access to up to 675 m^3 by day 4.	
		17.4	Recovered hydrocarbons and wastes will be transferred to licensed treatment facility for reprocessing or disposal.	
		17.5	Response teams will segregate liquid and solid wastes at the earliest opportunity.	
		17.6	Waste management provider support staff available year-round to assist in the event of an incident with waste management as detailed in contract.	
		17.7	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
		17.8	Waste management to be conducted in accordance with Australian laws and regulations	1, 3A, 3B, 3C, 4
		17.9	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.

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.
- The waste management requirements of all credible spill scenarios are well within Woodside's and its service providers existing capacity.
- 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 requirements of this technique does not justify the excessive costs of identified alternate, improved or additional controls.

5.7 Scientific monitoring

A scientific monitoring program (SMP) would be activated following a Level two or three unplanned hydrocarbon release, or any release event with the potential to contact sensitive environmental receptors. This would consider receptors at risk (ecological and socio-economic) for the entire predicted Environment that Maybe Affected (EMBA) and in particular, any identified Pre-emptive Baseline Areas (PBAs) for the credible spill scenario or other identified unplanned hydrocarbon releases associated with the operational activities (refer to **Table 2-1**).

The outputs of the stochastic hydrocarbon spill modelling were used to assess the environmental risk of the hydrocarbon affected area as delineated by the ecological impact EMBA and socio-cultural EMBA based on exceedance of environmental and social-cultural hydrocarbon threshold concentrations (refer to **Table 2-2** and see Section 4 and 6 of the Scarborough Seabed Intervention and Trunkline Installation activity EP for further information on applicable thresholds and the EMBAs). The PAP credible spill scenarios (CS-01, CS-02 and CS-03) defines the combined EMBA which is the basis of the SMP approach presented in this section.

It should be noted that the resulting SMP receptor locations differ from the Response Protection Areas presented and discussed in **Section 3** of this document due to the applicability of different hydrocarbon threshold levels. The SMP would be informed by the data collected via the operational monitoring program (OMP) studies; however, it differs from the OMP in being a long-term program independent of, and not directing, the operational oil spill response or monitoring of impacts from response activities (refer to **Section 5.1** for operational monitoring overview).

Key objectives of the Woodside oil spill SMP are:

- Assess the extent, severity and persistence of the environmental impacts from the spill event.
- Monitor subsequent recovery of impacted key species, habitats and ecosystems.

The SMP comprises ten targeted environmental monitoring programs to assess the condition of a range of physico-chemical (water and sediment) and biological (species and habitats) receptors including EPBC Act listed species, environmental values associated with protected areas and socio-economic values, such as fisheries. The ten SMPs are as follows:

- SM01 – Assessment of the presence, quantity and character of hydrocarbons in marine waters (linked to OM01 to OM03)
- SM02 – Assessment of the presence, quantity and character of hydrocarbons in marine sediments (linked to OM01 and OM05)
- SM03 – Assessment of impacts and recovery of subtidal and intertidal benthos
- SM04 – Assessment of impacts and recovery of mangroves/saltmarsh habitat
- SM05 – Assessment of impacts and recovery of seabird and shorebird populations
- SM06 – Assessment of impacts and recovery of nesting marine turtle populations
- SM07 – Assessment of impacts to pinniped colonies including haul-out site populations
- SM08 – Desktop assessment of impacts to other non-avian marine megafauna
- SM09 – Assessment of impacts and recovery of marine fish (linked to SM03)
- SM10 – Assessment of physiological impacts to important fish and shellfish species (fish health and seafood quality/safety) and recovery.

These SMPs have been designed to cover all key tropical and temperate habitats and species within Australian waters and broader, if required. A planning area for scientific monitoring is also identified to acknowledge potential hydrocarbon contact below the environmental threshold concentrations and beyond the EMBA. This planning area has been set with reference to the entrained low exposure value of 10 ppb detailed in NOPSEMA Bulletin #1 Oil Spill Modelling (2019), as shown in **Figure 5-1**.

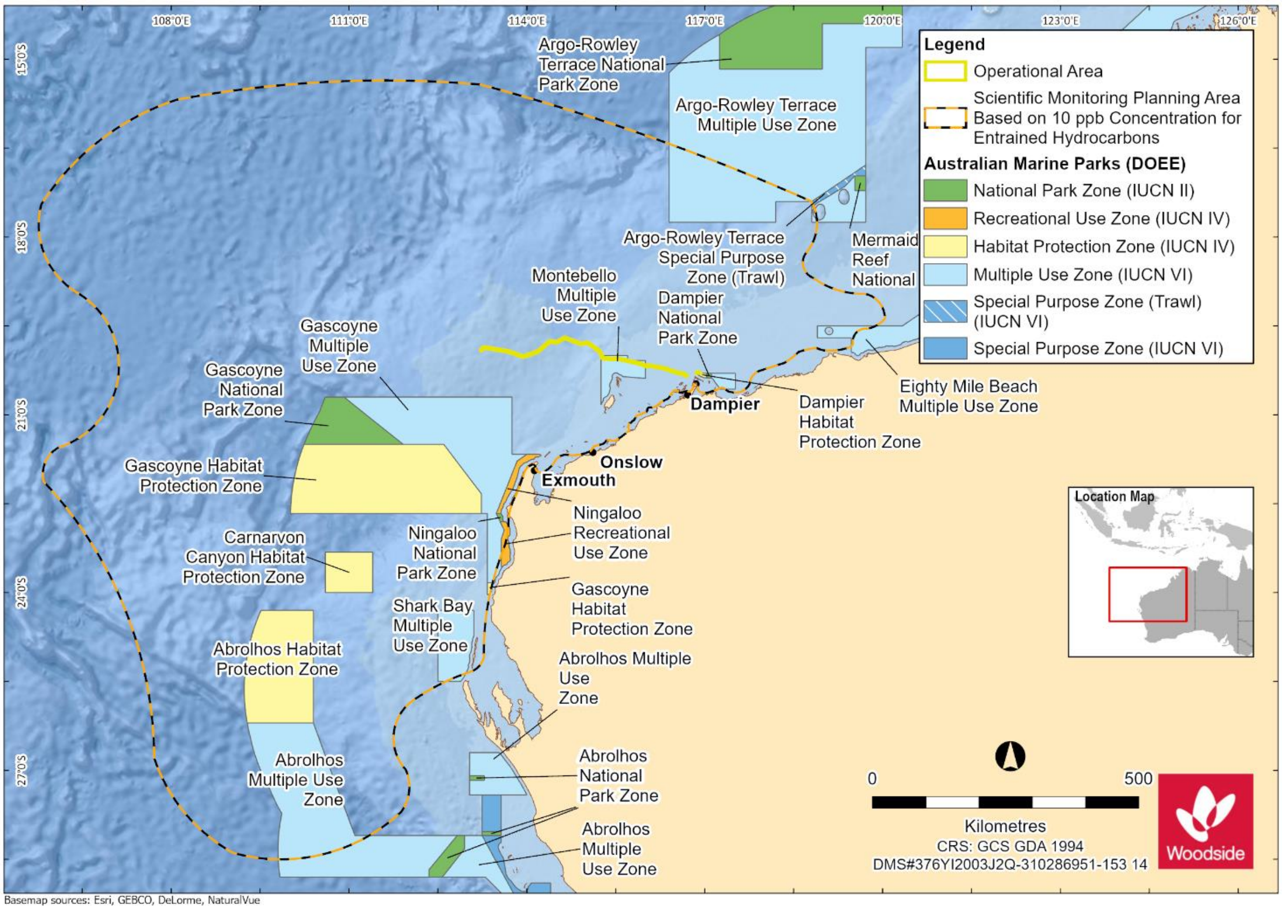

Figure 5-1: The planning area for scientific monitoring based on the area potentially contacted by the low (below ecological impact) entrained hydrocarbon threshold of 10 ppb representing the EMBA for the combined marine diesel credible spill scenarios (CS-01, CS-02 and CS-03)

Please note that **Figure 5-1** represents the overall combined extent of the marine diesel spill model outputs for the credible scenarios (CS-01, CS-02 and CS-03), based on a total of 100-200 replicate simulations over an annual period, and therefore represents the largest spatial boundaries of the spill combinations, not the spatial extent of a single spill.

5.7.1 Scientific monitoring deployment considerations

Table 5-14: Scientific monitoring deployment considerations

Scientific Monitoring Deployment Considerations	
Existing baseline studies for sensitive receptor locations predicted to be affected by a spill	PBAs of the following two categories: • PBAs within the predicted <10-day hydrocarbon contact time prediction: As part of this assessment, a desktop review was conducted 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). Furthermore, the need to conduct baseline data collection to address data gaps and demonstrate spill response preparedness is assessed (refer to Annex D). In the scenario, that baseline data needs are identified, planning for baseline data acquisition is typically commenced pre-PAP and the execution of studies undertaken considers the receptor type, seasonality and temporal assessment requirements and location conditions. • PBAs predicted >10 days to hydrocarbon contact: 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 **Table 5-15**). In the event of a spill, the SMP activation (as per the Scarborough Seabed Intervention and Trunkline Installation activity First Strike Response Plan) directs the SMP team to follow the steps outlined in the SMP Operational Plan. The steps include: the review of availability and type of existing baseline data, with particular reference to any Pre-emptive Baseline Areas (PBAs) identified as >10 days to hydrocarbon contact as predicted by forecast modelling trajectories. Such information is used to identify response phase PBAs and plan for the activation of SMPs for pre-emptive (i.e. pre-hydrocarbon contact) baseline assessment.
Pre-emptive Baseline in the event of a spill	Activation of SMPs in order to collect baseline data at sensitive receptor locations with predicted hydrocarbon contact time > 10 days (as documented in **ANNEX C**: Oil Spill Scientific monitoring Program).
Survey platform suitability and availability	In the event of the SMP activation, suitable survey platforms are available and can support the range of equipment and data collection methodologies to be implemented in nearshore and offshore marine environments.
Trained personnel to implement SMPs suitable and available.	Access to trained personnel and the sampling equipment contracted for scientific monitoring via a dedicated scientific monitoring program standby contract.
Met-ocean conditions	The following met-ocean conditions have been identified to implement SMPs: • Waves < 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

Table 5-15: Scientific monitoring response planning assumptions

Response Planning Assumptions	
PBAs	PBAs identified through the application of defined hydrocarbon impact thresholds during the Quantitative Spill Risk Assessment process and a consideration of the minimum time to contact at receptor locations fall into two categories: • PBAs for which baseline data are planned for and data collection may commence pre-PAP (≤ 10 days minimum time to contact), where identified as a gap. • PBAs (> 10 days minimum time to contact) for which baseline data may be collected in the event of an unplanned hydrocarbon release. Response phase PBAs are prioritised for SMP activities due to vulnerability (i.e. time to contact and environmental sensitivity) to potential impacts from hydrocarbon contact and an identified need to acquire baseline data. 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 Scarborough Seabed Intervention and Trunkline Installation activity. PBAs for Scarborough Seabed Intervention and Trunkline Installation activity are identified and listed in **ANNEX D**: Monitoring Program and Baseline Studies for the Petroleum Activities Program**, Table D-1**. The PBAs together with the situational awareness (from the operational monitoring) are the basis for the response phase SMP planning and implementation.
Pre-Spill	A review of existing baseline data for receptor locations with potential to be contacted by floating or entrained hydrocarbons at environmental thresholds within ≤10 days has identified the following based on the combined EMBA for the credible spill scenarios (CS-01, CS-02 and CS-03): • Rankin Bank [8] • Dampier Archipelago • Montebello Islands and Montebello State Marine Park • Barrow Island and the Lowendal Islands • Pilbara Islands – Middle and Southern Island Groups • Ningaloo coast and the Muiron Islands (state marine park, AMP and WHA) Australian Marine Parks (AMPs) potentially affected include: • Dampier AMP • Montebello AMP • Gascoyne AMP Note: The Australian Marine Parks (AMPs) are located in offshore, open waters where hydrocarbon exposure is possible on surface waters and in the upper water column (entrained hydrocarbons), only.

[8] Floating oil will contact submerged features in open ocean locations; therefore, only entrained hydrocarbon contact is predicted at ≤ 10 days. Predicted upper water column entrained hydrocarbons may extend to approximately 20 m depth and contact the submerged shoal benthic communities.

Response Planning Assumptions	
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 Incident Control Centre (ICC)) as the spill event unfolds and as the situational awareness provided by the OMPs permits delineation of the spill affected area (for example, updates to the spill trajectory tracking). The full list is presented in **ANNEX D**: Monitoring Program and Baseline Studies for the Petroleum Activities Program, based on the PAP credible spill scenarios (CS-01, CS-02 and CS-03) (**Table 2-1**). To address the initial focus in a response phase SMP planning situation, receptor locations predicted to be contacted between > 10 days have been identified as follows: • Glomar Shoal[9] • Pilbara Islands – Northern Island Group • Shark Bay outer barrier islands (Bernier and Dorre) • Argo-Rowley Terrace AMP • Shark Bay AMP • Abrolhos AMP 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**: Oil Spill Scientific monitoring Program for further details on the process for 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 ten 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 Scarborough Seabed Intervention and Trunkline Installation activity, dependent on the location of the hydrocarbon release, priority would be focused on Dampier Archipelago, Montebello, Barrow and Lowendal Island Groups, Ningaloo Coast and the Muiron Islands. ii. Highly sensitive and/or valued habitats and communities in coastal waters will be prioritised for pre-emptive baseline surveys over open water areas of AMPs, such as Dampier and Montebello AMPs. iii. 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.

[9] Floating oil will contact submerged features in open ocean locations; therefore, only entrained hydrocarbon contact is predicted at ≤ 10 days. Predicted upper water column entrained hydrocarbons may extend to approximately 20 m depth and contact the submerged shoal benthic communities.

Response Planning Assumptions	
Baseline Data	• A summary of the spill affected area and receptor locations as defined by the combined EMBA for the PAP credible spill scenarios (CS-01, CS-02 and CS-03), presented in the Scarborough Seabed Intervention and Trunkline Installation activity EP (Section 6). • The key receptors at risk by location and corresponding SMPs based on the EMBAs for the PAP are presented in **ANNEX D**: Monitoring Program and Baseline Studies for the Petroleum Activities Program, as per the PAP credible spill scenarios. This matrix maps the receptors at risk with their location and the applicable SMPs that may be triggered in the event of a Level two or three 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 locations identified as PBAs. • The status of baseline studies relevant to the PAP are tracked by Woodside through the maintenance of a Corporate Environment 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)[10] (refer to **ANNEX C**: Oil Spill Scientific monitoring Program).

5.7.3 Summary – scientific monitoring

The resulting scientific monitoring capability has been assessed against the PAP credible spill scenarios for marine diesel. The range of strategies provide an ongoing approach to monitoring operations to assess and evaluate the scale and extent of impacts. All known reasonably practicable control measures have been adopted with the cost and organisational complexity of these options determined to be moderate and the overall delivery effectiveness determined to be medium. The SMP's main objectives can be met, with no additional, alternative or improved control measures providing further benefit.

5.7.4 Response planning: need, capability and gap – scientific monitoring

The receptor locations identified in **ANNEX D**: Monitoring Program and Baseline Studies for the Petroleum Activities Program provide the basis of the SMPs likely to be selected and activated. Once the Woodside SMP Delivery team and Standby SMP 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.

Scope of SMP Operations in the event of a hydrocarbon spill

Receptor locations of interest for the SMP during the response phase in the event of a spill are:

- Dampier Archipelago
- Rankin Bank
- Montebello Islands and Montebello State Marine Park
- Barrow Island and the Lowendal Islands
- Pilbara Islands – Middle and Southern Island Groups
- Ningaloo Coast and Muiron Islands (State Marine Park, AMP and WHA)

Documented baseline studies are available for certain sensitive receptor locations including the Dampier Archipelago, Montebello Islands, Barrow Island, Lowendal Islands, Rankin Bank, Pilbara Islands – Middle and Southern Island Groups, and Ningaloo coast and the Muiron Islands (**ANNEX D**: Monitoring Program and Baseline Studies for the Petroleum Activities Program**, Table D-2**). The SMP approach in the response phase would still deploy SMP teams to maximise the opportunity to collect pre-emptive baseline data at sensitive receptor locations, i.e., the sections of the WA Coast not immediately contacted to hydrocarbons. As the exact locations where hydrocarbon contact

[10] https://biocollect.ala.org.au/imsa#max%3D20%26sort%3DdateCreatedSort

occurs may be unpredictable, SM01 would be mobilised as a priority to be able to detect hydrocarbons and track the leading edge of the spill to verify where hydrocarbon contact occurs which will assist with where SMP resources are a priority need to obtain pre-emptive baseline data.

The option analysis in **Section 6.7** considers ways to reduce the gap by considering alternate, additional, and/or improved control measures on each selected response strategy.

5.7.5 Environmental performance based on need

Table 5-16: Environment performance – scientific monitoring

Environmental Performance Outcome	Woodside can demonstrate preparedness to stand up the SMP to quantitatively assess and report on the extent, severity, persistence and recovery of sensitive receptors impacted from the spill event.			
Control measure		**Performance Standard**		**Measurement Criteria**
18	• Woodside has an established and dedicated SMP team comprising the Environmental Science Team and additional Environment Advisers within the Health Safety Environment (HSE) Function.	18.1	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.
19	• Woodside has contracted SMP service provider to provide scientific personnel to resource a base capability of one team per SMP (SM01-SM10, see **ANNEX C**: Oil Spill Scientific monitoring Program**, Table C-2**) as detailed in Woodside's SMP standby contractor Implementation Plan, to implement the oil spill scientific monitoring programs. The availability of relevant personnel is reported to Woodside on a monthly basis via a simple report on the base-loading availability of people for each of the SMPs comprising field work for data collection (SMP resourcing report register). • In the event of a spill and the SMP is activated, the base-loading availability of scientific personnel will be provided by SMP standby contractor for the individual SMPs and where gaps in resources are identified, SMP standby contractor/Woodside will seek additional personnel (if needed) from other sources including Woodside's Environmental Services Panel.	19.1	Woodside maintains the capability to mobilise personnel required to conduct scientific monitoring programs SM01 to 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 Master. • 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.
20	• Roles and responsibilities for SMP implementation are captured in **ANNEX C:** Oil Spill Scientific monitoring Program**, Table C-1**) 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	20.1	• Woodside has 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.

	functions to manage a loss of well control response. • SMP Team structure, interface with SMP standby contractor and linkage to the ICC is presented in **ANNEX C:** Oil Spill Scientific monitoring Program**, Figure C-1**. • Woodside has a defined Command, Control and Coordination structure for Incident and Emergency Management that is based on the Australasian Inter-Service Incident Management System (AIIMS) framework utilised in Australia. • Woodside uses an online Incident Management System (IMS) 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 Plan (FSP). • Step by step process to activation of individual SMPs provided in the SMP Operational Plan. • All decisions made regarding SMP logged in the online IMS (SMP team members trained in using Woodside's online Incident Management System). • SMP component input to the ICC IAP as per the identified ICC timed sessions and the SMP IAP logged on the online IMS. • 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 SMP for the SMP Standby contractor. • Woodside Environmental Science Team co-ordinates an annual SMP arrangement testing exercise which the Standby SMP contractor SMP team participates in since 2016 (refer to the SMP Document Register).			
21	• 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 **ANNEX C:** Oil	21.1	Woodside maintains standby SMP capability to mobilise equipment required to conduct scientific monitoring programs SM01 to SM10 (except desktop-based SM08): • Equipment are sourced through the existing standby contract with Standby SMP standby contractor, as detailed	• HSP Internal Control Environment tracks the quarterly review of the Oil Spill Contracts Master. • SMP standby monthly resource reports of equipment availability provided by SMP contractor (SMP resourcing report register).

	Spill Scientific monitoring Program, **Table C-2**). • 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 **ANNEX C**: Oil Spill Scientific monitoring Program, **Table C-2**)). Equipment would be sourced through the existing SMP standby contract with Standby SMP contractor for SMP resources and if additional surge capacity is required this would be available through the other Woodside Environmental Services Panel Contractors and specialist contractors. Standby SMP contractor can also address equipment redundancy through either individual or multiple suppliers. MoUs are in place with marine sampling equipment suppliers and analytical laboratories (SMP resourcing report register). • Availability of SMP equipment for offshore/onshore scientific monitoring team mobilisation is within one week to ten days of the commencement of a hydrocarbon release. This meets the SMP mobilisation lead time that will support meeting the response objective of 'acquire, where practicable, the environmental baseline data prior to hydrocarbon contact required to support the post-response SMP.		within the SMP Implementation Plan.	• SMP annual arrangement testing and reporting.
22	Woodside's SMP approach addresses the pre-PAP acquisition of baseline data for PBAs with ≤ 10 days if required following a baseline gap analysis process. Woodside maintains knowledge of Environmental Baseline data through: • Documentation annual reviews of the Woodside Baseline Environmental Studies Database, and specific activity baseline gap analyses. • 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).	22.1	• 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 data achieved.			
Control measure		**Performance Standard**		**Measurement Criteria**
23	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.	23.1	**PBA baseline data acquisition in the response phase** If baseline data gaps are identified for PBAs that has predicted hydrocarbon contact (contact time > 10 days), there will be a response phase effort to collect baseline data with priority in implementing SMPs given to receptors where pre-emptive baseline data can be acquired or improved. SMP team (within the Environment Unit of the ICC) contribute SMP component of the ICC Planning Function in development of the IAP.	• Response SMP plan. • Woodside's online Incident Management System Records. • SMP component of the Incident Action Plan.
		23.2	**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. • IAPs.

Environmental Performance Outcome	Implementation of the SMP (response and post-response phases).			
Control measure		**Performance Standard**		**Measurement Criteria**
24	• Scientific monitoring will address quantitative assessment of environmental impacts of a level two or three spill or any release event with the potential to contact sensitive environmental receptors. The SMP comprises ten targeted environmental monitoring programs. • SMP supporting documentation: (1) Oil Spill Scientific Monitoring Operational Plan; (2) SMP Implementation Plan and (3) SMP Process and Methodologies Guideline. • The Oil Spill Scientific Monitoring Operational Plan details the process of SMP selection, input to the IAP to trigger operational logistic support services. Methodology documents for each of the ten SMPs are accessible detailing equipment, data collection techniques and the specifications required for the survey platform support. • The SMP standby contractor holds a Woodside SMP implementation plan detailing activation processes, linkage with the Woodside SMP team and the general principles for the planning and mobilisation of SMPs to deliver the individual SMPs activated. Monthly resourcing report are issued by the SMP standby contractor (SMP resourcing report register). All SMP documents and their status are tracked via SMP document register.	24.1	**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.
		24.2	**Implementation of SM02 to SM10** SM02-SM10 will be implemented in accordance with the objectives and activation triggers as per **ANNEX C**: Oil Spill Scientific monitoring Program**, Table C-2**.	Evidence SMPs have been triggered: • Documentation as per requirements of the SMP Operational Plan. • Woodside's online Incident Management System Records. • SMP component of the IAP. • SMP Data records from field.
		24.3	**Termination of SMP plans** The Scientific Monitoring Program will be terminated in accordance with termination triggers for the SMPs detailed in **ANNEX C**: Oil Spill Scientific monitoring Program**, Table C-2**, and the Termination Criteria Decision-tree for Oil Spill Environmental Monitoring (**ANNEX C**: Oil Spill Scientific monitoring Program**, Figure C-3**):	Evidence of Termination Criteria triggered: • Documentation and approval by relevant stakeholders to end SMPs for specific receptor types.

5.8 Incident Management System

The Incident Management System (IMS) is both a control measure and a measurement criterion. 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 criterion 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 incident controller (IC) may request the ICC to complete notifications internally within Woodside, to stakeholders and government agencies as required. Depending on the type and scale of the incident either the ICC Duty Manager (DM) or IC will be responsible for ensuring the development of the IAP. Incident Action Planning is an ongoing process that involves continual review to ensure techniques to control the incident are appropriate to the situation at the time.

5.8.2 Operational NEBA 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 a 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 as outlined in **Table 5-17**. 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.

5.8.4 Environmental performance based on need

Table 5-17: Environmental Performance – Incident Management System

Environmental Performance Outcome		To support the effectiveness of all other control measures and monitor/record the performance levels achieved.		
Control measure		**Performance Standard**		**Measurement Criteria (Section 5.9)**
25	Operational NEBA	25.1	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
		25.2	Record the evidence and justification for any deviation from the planned response activities.	
		25.3	Record the information and data from operational and scientific monitoring activities used to inform the NEBA.	
26	Stakeholder engagement	26.1	Prompt and record all notifications (including government notifications) for stakeholders in the region are made	
		26.2	In the event of a response, identification of relevant stakeholders will be re-assessed throughout the response period.	
		26.3	Undertake communications in accordance with: • Woodside Crisis Management Functional Support Team Guideline – Reputation • External Communication and Continuous Disclosure Procedure • External Stakeholder Engagement Procedure	
27	Personnel required to support any response	27.1	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
		27.2	A duty roster of trained and competent people will be maintained to ensure that minimum manning requirements are met all year round.	3C
		27.3	Immediately activate the IMT with personnel filling one or more of the following roles: • Operations Duty Manager • D&C Duty Manager • Operations Coordinator • Deputy Operations Coordinator • Planning Coordinator • Logistics (materials, aviation, marine and support positions) • Management Support • Health and Safety Advisor • Environment Duty Manager • People Coordinator • Public Information Coordinator • Intelligence Coordinator; and • Finance Coordinator.	1, 2, 3B, 3C, 4
		27.4	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.	
		27.5	Security and emergency management (S&EM) advisors will be integrated into ICC to monitor performance of all functional roles.	
		27.6	Continually communicate the status of the spill and support Woodside to determine the most appropriate response by delivering on the responsibilities of their role.	
		27.7	Follow the OPEA, Operational Plans, FSPs, support plans and the IAPs developed.	1, 2, 3A, 4

		27.8	Contribute to Woodside's response in accordance with the aims and objectives set by the Duty Manager.	1, 2, 3B, 3C, 4

5.9 Measurement criteria for all response techniques

Woodside ensures compliance with environmental performance outcomes and standards through four primary mechanisms. The performance tables aforementioned identify which of these four mechanisms monitors the readiness and records the effectiveness and performance of the control measures adopted.

1. The Incident Management System

The Incident Management System (IMS) supports the implementation of the Incident 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 Incident 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 communicates the:

- Incident objectives;
- Status of assets;
- Operational period objectives;
- Response techniques (defined during response planning); and
- 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

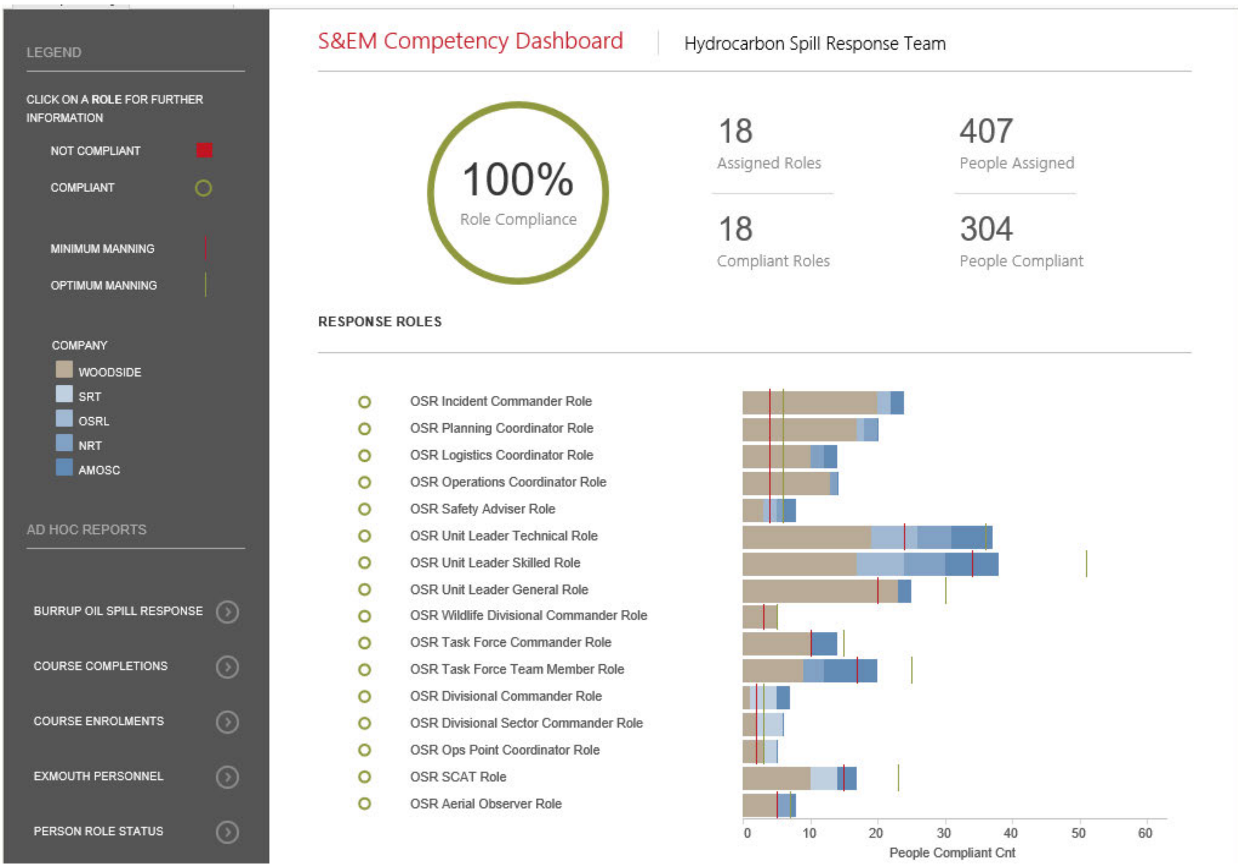

Figure 5-2: Example screen shot of the hydrocarbon spill preparedness (HSP) competency dashboard

The Dashboard is one of Woodside's key means of monitoring its readiness to respond. It also and 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.

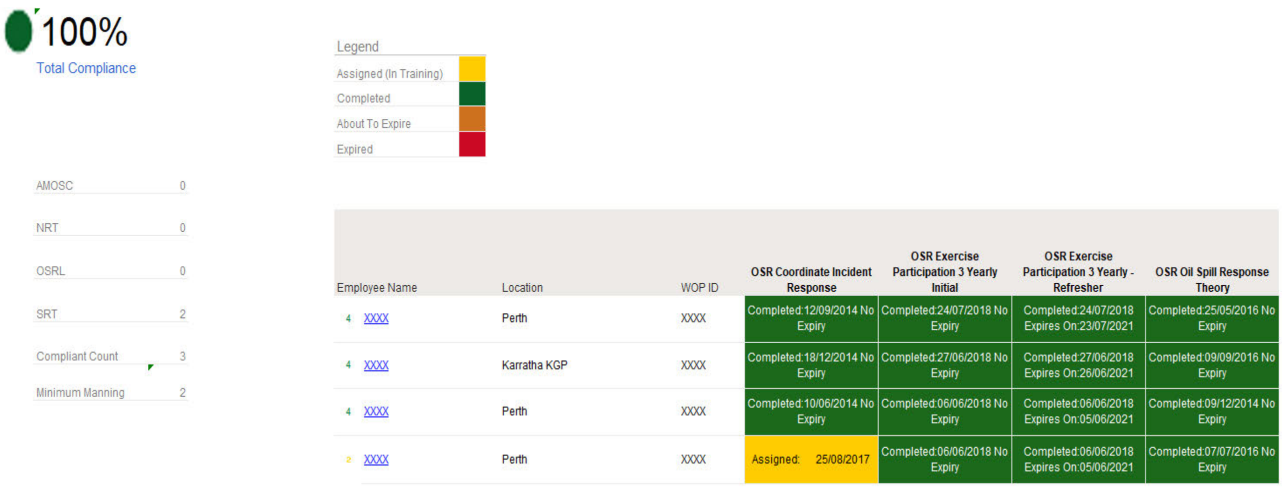

Figure 5-3: Example screen shot for the Ops Point Coordinator role

3. The Hydrocarbon Spill Preparedness ICE Assurance Process

The Hydrocarbon Spill Response Team has developed a Hydrocarbon Spill Preparedness and Response Internal Control Environment (ICE) process to align and feed into the Woodside Management System Assurance process for hydrocarbon spill. The process tracks compliance over four key control areas:

a) **Plans** – Ensures all plans (including: Oil Pollution Emergency Arrangements, first strike response plans, operational plans, support plans and tactical response plans in Annex E) 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, Crisis Management Team (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[11] vessel schedule, dispersant availability, rig/vessels monitoring, equipment stockpiles, tracking buoy locations and the CICC duty roster.

d) **Compliance & Assurance** – Ensures all regulator inspection outcomes are actioned and closed out, the global legislation register is up to date and that the key assurance components are tracked and managed. Assurance activities (including Audits) conducted on memberships with key Oil Spill Response Organisations (OSROs) including AMOSC and OSRL are also tracked and recorded in the ICE.

The ICE assurance process records how each commitment listed in the performance tables above is managed to ensure ongoing compliance monitoring. The level of compliance can be reviewed in real time and is reported on a monthly basis through the S&EM Function.

The completion of the assurance checks (over and above the ICE process) is also applied via the Woodside Integrated Risk & Compliance System (WiRCs) and subject to the requirements of Woodside's Provide Assurance Procedure.

4. The Hydrocarbon Spill Preparedness and Response Procedure

This procedure sets out how to plan and prepare for a liquid hydrocarbon spill to the marine environment. (Note, this procedure does not apply to scenarios relating to gas releases in the marine environment).

This procedure details the:

- Requirement for an 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; and
  - Maintaining access to identified equipment and personnel.
- Planning for hydrocarbon spill response preparedness
- Accountabilities for hydrocarbon spill response preparedness
- Spill training requirements
- Requirements for spill exercising / testing of spill response arrangements

[11] 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

- Spill equipment and services requirements.

The procedure also details the roles and responsibilities of the dedicated Woodside Hydrocarbon Spill Preparedness team. This team is responsible for:

- Assuring that Woodside hydrocarbon spill responders meet competency requirements.
- Establishing the competency requirements, annual training schedule and a training register of trained personnel.
- Establishing and maintaining the total numbers of trained personnel required to provide an effective response to any hydrocarbon spill incident.
- Ensuring equipment and services contracts are maintained
- Establishing OPEPs
- Establishing OPEAs
- Priority response receptor determination
- ALARP determination
- Ensuring compliance and assurance is undertaken in accordance with external and internal requirements.

6 ALARP EVALUATION

This Section should be read in conjunction with **Section 5** which is the capability planned for this activity.

6.1 Monitor and evaluate – ALARP assessment

Alternative, Additional and Improved options have been identified and assessed against the base capability described in **Section 5** with those that have been selected for implementation highlighted in green. Items highlighted in red have been considered and rejected on the basis that they are not feasible, the costs are clearly disproportionate to the environmental benefit, and/or the option is not reasonably practical. Control measures where there is not a clear justification for their inclusion or exclusion may be subject to a detailed ALARP assessment.

6.1.1 Monitor and Evaluate – Control Measure Options Analysis

6.1.1.1 Alternative Control Measures

Alternative Control Measures considered *Alternative, including potentially more effective and/or novel control measures are evaluated as replacements for an adopted control*					
Option considered	**Environmental consideration**	**Feasibility**	**Approximate cost**	**Assessment conclusions**	**Implemented**
Aerostat (or similar inflatable observation platform) for localised aerial surveillance.	Lead time to Aerostat surveillance is disproportionate to the environmental benefit. The system also provides a very limited field of visibility around the vessel it is deployed from.	Long lead time to access (>10 days). Each system would require an operator to interpret data and direct vessels accordingly. Requires multiple systems for shoreline use.	Purchase cost per system approx. 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	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	This option is not adopted as the minimal environmental benefit gained is disproportionate to the cost	**No**

Additional Control Measures considered *Additional control measures are evaluated in terms of them reducing an environmental impact or an environmental risk when added to the existing suite of control measures*					
		contractor has person on call to respond from their own location.	for 24hr access plus an initial A$5000 per modelling run.	and the challenge of collecting essential data/implementing reliable modelling in shorter timeframes.	
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, the following controls were selected for implementation for the PAP.

- Alternative
  - None selected
- Additional
  - None selected
- Improved
  - None selected

6.2 Source control via Vessel SOPEP - ALARP assessment

Alternative, Additional and Improved options have been assessed against the base capability described in Section 5 with those that have been selected for implementation highlighted in green. Items highlighted in red have been considered and rejected on the basis that they are not feasible, the costs are disproportionate to the environmental benefit, and/or the option is not reasonably practical. Control measures where there is not a clear justification for their inclusion or exclusion may be subject to a detailed ALARP assessment.

6.2.1 Source Control via Vessel SOPEP – Control Measure Options Analysis

6.2.1.1 Alternative Control Measures

Alternative Control Measures considered *Alternative, including potentially more effective and/or novel control measures are evaluated as replacements for an adopted control*				
Option considered	**Environmental consideration**	**Feasibility**	**Cost**	**Implemented**
No reasonably practical alternative control measures identified.				N/A

6.2.1.2 Additional Control Measures

Additional Control Measures considered *Additional control measures are evaluated in terms of them reducing an environmental impact or an environmental risk when added to the existing suite of control measures*				
Option considered	**Environmental consideration**	**Feasibility**	**Cost**	**Implemented**
No reasonably practical alternative control measures identified.				N/A

6.2.1.3 Improved Control Measures

Improved Control Measures considered *Improved control measures are evaluated for improvements they could bring to the effectiveness of adopted control measures in terms of functionality, availability, reliability, survivability, independence and compatibility*				
Option considered	**Environmental consideration**	**Feasibility**	**Cost**	**Implemented**
No reasonably practical alternative control measures identified.				N/A

6.2.2 Selected control measures

Following review of alternative, additional and improved control measures, the following controls were selected for implementation for the PAP.

- Alternative
  - None selected
- Additional
  - None selected
- Improved
  - None selected

6.3 Shoreline Protection and Deflection - ALARP Assessment

Alternative, Additional and Improved options have been identified and assessed against the base capability described in **Section 5** with those that have been selected for implementation highlighted in green. Items highlighted in red have been considered and rejected on the basis that they are not feasible, the costs are clearly disproportionate to the environmental benefit, and/or the option is not reasonably practical. Control measures where there is not a clear justification for their inclusion or exclusion may be subject to a detailed ALARP assessment.

6.3.1 Existing Capability – Shoreline Protection and Deflection

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.

6.3.2 Response Planning: Scarborough Seabed Intervention and Trunkline Installation – Shoreline Protection and Deflection

Planning for shoreline protection is based upon identification of Response Protection Areas (RPAs) from deterministic modelling and the logistics associated with deploying protection at these locations. The response planning scenarios indicate that this would require effective mobilisation to priority shorelines and maintenance of protection until operational monitoring confirms that the locations were no longer at risk. Woodside has identified the RPAs from deterministic modelling results provided from specific scenarios.

The control measures selected provide capability to mobilise shoreline protection equipment within 24 hours.

Modelling for CS-01 indicates that the shortest timeframe for shoreline contact at the Dampier Archipelago is 2.2 days. No shoreline impact is predicted for CS-02 and CS-03.

The existing capability is considered sufficient to mobilise and deploy protection at all identified RPAs prior to hydrocarbon contact. In the event of a real spill, protection activities will be guided by predictive modelling, direct observation/surveillance and remote sensing methods (OM01, OM02 and OM03) which will be employed from the outset of a spill to track the oil and assess receptors at risk. This will then trigger the undertaking of pre-emptive assessments of sensitive receptors at risk (OM04). OM04 would only be undertaken in liaison with WA DoT. Due to potentially high levels of volatiles from a spill of marine diesel, shoreline protection and deflection operations would only be undertaken if safety of responders could be ensured.

TRPs exist for many of the RPAs identified. The plans identify values and sensitivities that would be protected at each location. Modelling does not predict that all priority protection shorelines will be at risk of contact at the same time. Therefore, to allow for the best use of available shoreline protection and deflection resources, operational monitoring (OM01, OM02 and OM03) will inform the response, targeting RPAs where contact is predicted. **Table 6-1** below outlines the capability required (number of RPAs predicted to be impacted) against the capability available (number of shoreline protection and deflection operations that can be mobilised and deployed). As can be seen from the table below. Woodside's capability exceeds the response planning need identified for shoreline protection and deflection operations at identified RPAs.

Table 6-1: Response planning – shoreline protection and deflection

	Shoreline Protection & Deflection (SPD)	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7		Week 2	Week 3	Week 4		Month 2	Month 3	Month 4
	Oil on shoreline (from deterministic modelling) m^3	0	3	0	0	0	0	0		0	0	0		0	0	0
A	Capability Required															
A1	Number of RPAs contacted (> 100 g/m^2) – Marine diesel release (CS-01)	0	1	0	0	0	0	0		0	0	0		0	0	0
B	Capability Available (operations per day)															
B1	SPD operations available – per day (lower)	0	1	1	2	2	4	6		70	70	70		330	330	330
B2	SPD operations available – per day (upper)	1	2	3	4	6	8	10		84	84	84		336	336	336
C	Capability Gap (operations per day)															
C1	SPD operations gap – per day (lower)	0	0	0	0	0	0	0		0	0	0		0	0	0
C2	SPD operations gap – per day (upper)	0	0	0	0	0	0	0		0	0	0		0	0	0

A1 – the number of Response Protection Areas contacted by surface hydrocarbons above 100 g/m^2
*B1 and B2 – the upper and lower number of shoreline protection and deflection operations available (based on response planning assumptions in **Section 0**),*
C1 and C2 – the gap between the upper and lower number of shoreline protection and deflection operations required in A1 compared to the operations available in B1 and B2

Table 6-2: RPAs for Scarborough Seabed Intervention and Trunkline Installation

Areas of coastline contacted	Conservation status	IUCN protection category	CS-01	
			Minimum time to shoreline contact (above 100 g/m^2) in days (12)	Maximum shoreline accumulation (above 100 g/m^2) in m^3 (13)
Dampier Archipelago	National Heritage Property	N/A	2.2	3 m^3

[12] This volume and time represent the first time to contact on defined shoreline polygon and the maximum volume ashore for that 24 hour period.
[13] This volume and time represent the maximum volume ashore on defined shoreline polygon for any 24 hour time period

Table 6-3: Indicative Tactical response plan, objectives and methods for RPAs with predicted contact

Tactical Response Plan	Response aims and methods
Legendre Island – Dampier	**First response aim:** Ongoing operational monitoring and evaluation of the hydrocarbon spill to adapt aims and response tactics to the evolving nature of the incident and to assist in locating relevant booming areas. **Second response aim:** Protection of sensitive shorelines (mangrove) at Legendre Island through use of shoreline booms. Formation types to deploy will be dependent on the time available until the hydrocarbon impacts the shoreline and local geographical and tidal/weather conditions **Third response aim:** Clean-up of the shoreline. Manual clean up techniques, use of mechanical recovery methods and techniques where appropriate **Fourth response aim:** Collection and specialist cleaning/rehabilitation of oiled wildlife • Relevant permissions must be sought from DBCA to carry out any response operations within the limits of the area • In the event that the existing Woodside equipment stockpile at the King Bay Supply Base becomes exhausted, Woodside has an MOU with AMSA and the DoT to provide surplus equipment from their stockpile. Additionally, Woodside is a member of both AMOSC and OSRL and has the ability to call upon their relevant technical advisory services and equipment stockpiles 24/7. NOTE: This TRP should be considered a draft until it has been verified and tested.
Rosemary Island – Dampier	**First response objective:** Ongoing operational monitoring and evaluation of the hydrocarbon spill to adapt aims and response tactics to the evolving nature of the incident and to assist in locating relevant booming areas **Second response objective**: Recovery of floating oil at sea where possible through the use of skimming systems and other appropriate recovery devices to reduce shoreline impact **Third response objective:** Protection of sensitive shorelines at Rosemary Island through use of shoreline booms. Formation types to deploy will be dependent on the time available until the hydrocarbon impacts the shoreline and local geographical and tidal/weather conditions **Fourth response objective**: Clean-up of the shoreline. Manual clean up techniques, use of mechanical recovery methods and techniques where appropriate • Relevant permissions must be sought from DBCA to carry out any response operations within the limits of the area • In the event that the existing Woodside equipment stockpile at the King Bay Supply Base becomes exhausted, Woodside has an MOU with AMSA and the DoT to provide surplus equipment from their stockpile. Additionally, Woodside is a member of both AMOSC and OSRL and has the ability to call upon their relevant technical advisory services and equipment stockpiles 24/7. NOTE: • See Port of Dampier MOPP page 113 for Rosemary Island response plan. • Dependent on seasonality presence of sensitive receptors, the strategies to either protect or clean-up the shorelines will be decided through NEBA. • This TRP should be considered a draft until it has been verified and tested.

Pre-emptive mobilisation of equipment and personnel would commence as soon as practicable prior to oil contact. Additional resources would be mobilised depending on the scale of the event to increase the length or number of shorelines being protected.

A shoreline protection and deflection response would be launched and any additional TRPs drafted only when operational monitoring (OM02 and OM03) and modelling (OM01) indicate that contact could occur at RPA(s). The outputs from the monitoring will inform the need for and/or direct any additional response techniques and, additionally, if/when the spill enters State Waters and control of the incident passes to WA DoT.

6.3.3 Shoreline Protection and Deflection – Control Measure Options Analysis

6.3.3.1 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**
Pre-position equipment at Response Protection Areas (RPAs)	Additional environmental benefit of having equipment prepositioned is considered minor. Equipment is currently available to RPAs and additional shorelines, within estimated minimum times until shoreline contact at RPAs, enabling mobilisation of the selected delivery options.	The incremental environmental benefit associated with these delivery options is considered minor and unlikely to reduce the environmental consequence of a significant hydrocarbon release beyond the adopted delivery options. Considering the highly unlikely nature of a significant hydrocarbon release and the costs and organisational complexity associated with prepositioning and maintenance of equipment, the sacrifice is considered disproportionate to the limited environmental benefit that might be realised. Furthermore, these options would conflict with the mutual aid philosophy being adopted under the selected delivery options. The selected delivery options for shoreline protection and deflection meet the relevant objectives of this control measure and do not require prepositioned or additional equipment in Exmouth.	Total cost to preposition protection/ deflection packages at each site of potential impact would be approx. A$6100 per package per day.	This option is not adopted as the existing capability meets the need.	**No**

6.3.3.2 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**
Supplemented stockpiles of equipment in Exmouth to protect additional shorelines	Additional equipment would increase the number of receptor areas that could be protected from hydrocarbon contact. However, current availability of personnel and equipment is capable of protecting up to 30 km of shoreline, commensurate with the scale and progressive nature of shoreline impact. Additional stocks would be made available from international sources if long term up scaling were necessary. A reduction in environmental consequence from a 'B' rating (serious long-term impacts) is unlikely to be realised as a result of having more equipment available locally.	The incremental environmental benefit associated with these delivery options is considered minor and unlikely to reduce the environmental consequence of a significant hydrocarbon release beyond the adopted delivery options. Considering the highly unlikely nature of a significant hydrocarbon release and the costs and organisational complexity associated with prepositioning and maintenance of equipment, the sacrifice is considered disproportionate to the limited environmental benefit that might be realised. Furthermore, these options would conflict with the mutual aid philosophy being adopted under the selected delivery options. The selected delivery options for shoreline protection and deflection meet the relevant objectives of this control measure and do not require prepositioned or additional equipment in Exmouth.	Total cost for purchase supplemental protection and deflection equipment would be approx. A$455,000 per package.	This option is not adopted as the existing capability meets the need.	**No**
Additional trained personnel	The level of training and competency of the response personnel ensures the shoreline protection and deflection operation is delivered with minimum secondary impact to the environment. Training additional personnel does not provide an increased environmental benefit.	Additional personnel required to sustain an extended response can be sourced through the Woodside *People & Global Capability Surge Labour Requirement Plan*. Additional personnel sourced from contracted OSRO's (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 is not adopted as the existing capability meets the need.	**No**

6.3.3.3 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 2.5 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 24-48hrs of activation. Additional equipment from existing stockpiles and oil spill response service providers can be on scene within days. Given modelling does not predict shoreline accumulation until approx. 2.5 days, Woodside considers that there is sufficient time for deployment of protection and deflection operations prior to impact.	The cost of establishing a local stockpile of new mitigation equipment (including protection and deflection boom) 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**

6.3.4 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
  - None selected
- Improved
  - None selected

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 exiting level of capability is based on internal and third-party resources that are available 24 hours, 7 days per week. The capability presented below is displayed as ranges to incorporate operational factors such as weather, crew/vessel/aircraft/vehicle location and duties, survey or classification society inspection requirements, overflight/port/quarantine permits and inspections, crew/pilot duty and fatigue hours, refuelling/re-stocking provisions, and other similar logistic and operational limitation that are beyond Woodside's direct control.

6.4.2 Response planning: Scarborough Seabed Intervention and Trunkline Installation - 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.

Modelling for CS-01 indicates that the shortest timeframe for shoreline contact at the Dampier Archipelago is 2.2 days. No shoreline impact is predicted for CS-02 and CS-03.

The maximum shoreline accumulation volumes from CS-01 have been presented for any given day/ week / month of the response to provide a single response planning scenario so that it provides a worst-case scenario for planning purposes, as outlined below in **Table 6-4**. The existing shoreline clean-up capability would be sufficient by Day 2. From Day 2 onwards, the available response capability is predicted to be sufficient as the number of personnel and equipment mobilised to RPAs increases. The volumes of accumulated oil and the required scale of the response will also depend on the success of other offshore techniques preventing shoreline oiling occurring; other offshore response techniques and their associated reduction in oil volumes have not been taken into account when determining the shoreline clean-up requirements in **Table 6-4** and the approach is therefore conservative.

The potential scale and remoteness of a response 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 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7	Week 2	Week 3	Week 4	Month 2	Month 3	Month 4	Month 5
	Oil on shoreline (from deterministic modelling) m^3														
	Shoreline accumulation (above 100 g/m^2) – m^3	0	3	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	1	0	0	0	0	0	0	0	0	0	0	0	0
A2	Shoreline clean-up operations required (upper)	0	1	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 5.2**),*
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

Table 6-5: RPAs for Scarborough Seabed Intervention and Trunkline Installation

Areas of coastline contacted	Conservation status	IUCN protection category	CS-01	
			Minimum time to shoreline contact (above 100 g/m^2) in days [14]	Maximum shoreline accumulation (above 100 g/m^2) in m^3 [15]
Dampier Archipelago	National Heritage Property	N/A	2.2	3 m^3

[14] This volume and time represent the first time to contact on defined shoreline polygon and the maximum volume ashore for that 24 hour period.
[15] This volume and time represent the maximum volume ashore on defined shoreline polygon for any 24 hour time period

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**	**Approx. cost**	**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**	**Implemented**
Train additional personnel in shoreline clean-up	No environmental benefit is gained through having additional personnel trained. Current personnel arrangements meet the ongoing need for trained personnel for all scenarios.	It is feasible to train more personnel in shoreline clean-up, however, additional personnel required to sustain an extended response can be sourced through the Woodside People & Global Capability Surge Labour Requirement Plan. This surge capacity is not expected to be required for any of the scenarios.	Given there is no environmental benefit, any costs are disproportionate to the benefit gained.	**No**
Additional trained personnel deployed	Maintaining 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, however 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. Therefore, no environmental benefit is expected from deploying additional trained personnel past 200.	It is feasible to deploy additional trained personnel in addition to the 200 already sourced through existing arrangements. These could be sourced through existing contracts with oil spill response organisations, labour hire organisations and environmental panel contractors. This additional capacity is not expected to be required for any of the scenarios.	Given there is no environmental benefit, any costs are disproportionate to the benefit gained.	**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**	**Implemented**
Faster response/mobilisation time	No environmental benefit is identifiable due to the timeframes to contact.	It is feasible to preposition equipment and personnel in Dampier to allow a faster mobilisation time. However, response teams, trained personnel, contracted oil spill response service providers, government agencies and the associated mitigation equipment required to enact an initial response will be available for mobilisation within the first week. Additional equipment from existing stockpiles and oil spill response service providers can be on scene within 6 days.	Given there is no environmental benefit, any costs are disproportionate to the benefit gained.	**No**

6.4.4 Selected control measures

Following review of alternative, additional and improved control measures, the following controls were selected for implementation for the PAP.

- Alternative
  - None selected

- Additional
  - None selected
- Improved
  - None selected

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 exiting level of capability is based on internal and third-party resources that are available 24 hours, 7 days per week. The capability presented below is displayed as ranges to incorporate operational factors such as weather, crew/vessel/aircraft/vehicle location and duties, survey or classification society inspection requirements, overflight/port/quarantine permits and inspections, crew/pilot duty and fatigue hours, refuelling/re-stocking provisions, and other similar logistic and operational limitation that are beyond Woodside's direct control.

6.5.2 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**	**Implemented**
Direct contracts as 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	**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**	**Implemented**
Additional wildlife treatment systems	Current arrangements allow for all wildlife to be treated. Hydrocarbon is only limited to open water above the impact threshold. Therefore, there is no environmental benefit for having additional wildlife treatment systems as current capability meets the need.	Current arrangements allow response equipment and personnel to be delivered by day one, scaling up by day six, enough to treat up to 600 wildlife. An additional wildlife treatment system is feasible and would potentially reduce the time to deploy additional wildlife systems.	Given there is no environmental benefit, any costs are disproportionate to the benefit gained.	**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.	Providing additional trained wildlife responders is feasible, however current capacity provides the capacity to treat approximately 600 wildlife units (primarily avian fauna) by day six, with additional capacity available from OSRL.	Given there is no environmental benefit, any costs are disproportionate to the benefit gained.	**No**

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**	**Implemented**
Faster mobilisation time for wildlife response through pre-positioned equipment and personnel.	Response time is limited by specialist personnel mobilisation time. Current timing is sufficient considering there is no potential for shoreline receptors to be contacted.	The selected delivery options provide the capacity to mobilise an oiled wildlife response capable of treating up to 600 wildlife from at least day six and exceeds the estimated Level 4 OWR response thought to be applicable. This delivery option	The cost of having dedicated equipment and personnel available to respond faster is considered disproportionate to the environmental benefit.	**No**

	This control measure provides increased effectiveness through faster mobilisation of specialists. However, no significant net environmental benefit is expected due to shoreline stranding times.	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.		

6.5.3 Selected control measures

Following review of alternative, additional and improved control measures, the following controls were selected for implementation for the PAP.

- Alternative
  - None selected
- Additional
  - None selected
- Improved
  - None selected

6.6 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 exiting level of capability is based on internal and third-party resources that are available 24 hours, 7 days per week. The capability presented below is displayed as ranges to incorporate operational factors such as weather, crew/vessel/aircraft/vehicle location and duties, survey or classification society inspection requirements, overflight/port/quarantine permits and inspections, crew/pilot duty and fatigue hours, refuelling/re-stocking provisions, and other similar logistic and operational limitation that are beyond Woodside's direct control.

6.6.2 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**	**Approx. cost**	**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**	**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.	The cost of having increased waste storage capability is considered disproportionate to the environmental benefit.	**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**	**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 time of the event is considered low and existing arrangements provide adequate storage to support the response.	Woodside already maintains an equipment stockpile in Exmouth to enable shorter response times to incidents. This stockpile includes temporary waste storage equipment. Woodside has access to stockpiles of waste storage and equipment in Dampier and Exmouth through existing contracts and arrangements.	The incremental benefit of having a dedicated local Woodside owned stockpile of waste equipment and transport is considered minor and cost is considered disproportionate to the benefit gained given predicted shoreline contact times.	**No**

6.6.3 Selected control measures

Following review of alternative, additional and improved control measures, the following controls were selected for implementation for the PAP.

- Alternative
  - None selected
- Additional
  - None selected
- Improved
  - None selected

6.7 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 Scientific monitoring – control measure options analysis

6.7.1.1 Alternative Control Measures

Evaluate Alternative, Additional and Improved Control Measures

Alternative Control Measures considered

Alternative, including potentially more effective and/or novel control measures are evaluated as replacements for an adopted control

Ref	Control Measure Category	Option considered	Implemented	Environmental Consideration	Feasibility/Cost
SM01	System	Analytical laboratory facilities closer to the likely spill affected area	**No**	SM01 water quality monitoring requires water samples to be transported to NATA rated laboratories in Perth or interstate. Consider the benefit of laboratory access and transportation times to deliver water samples and complete lab analysis. There is a time lag from collection of water samples to being in receipt of results and confirming hydrocarbon contact to sensitive receptors). The environmental consideration of having access to suitable laboratory facilities in Exmouth or Karratha to carry out the hydrocarbon analysis would provide faster turnaround in reporting of results only by a matter of days (as per the time to transport samples to laboratories).	Laboratory facilities and staff available at locations closer to the spill affected area can reduce reporting times only to a moderate degree (days) with associated high costs of maintaining capability do not improve the environmental benefit.
SM01	System	Dedicated contracted SMP vessel (exclusive to Woodside)	**No**	Would provide faster mobilisation time of scientific monitoring resources, environmental benefit associated with faster mobilisation time would be minor compared to selected options.	Chartering and equipping additional vessels on standby for scientific monitoring has been considered. The option is reasonably practicable but the sacrifice (charter costs and organisational complexity) is significant, particularly when compared with the anticipated availability of vessels and resources within in the required timeframes. The selected delivery provides capability to meet the scientific monitoring objectives, including collection of pre-emptive data where baseline knowledge gaps are identified for receptor locations where spill predictions of time to contact are > 10 days. The effectiveness of this alternative control (weather dependency, availability and survivability) is rated as very low. The cost and organisational complexity of employing a dedicated response vessel is considered disproportionate to the potential environmental benefit by adopting these delivery options.

6.7.1.2 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

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 an instantaneous MDO release from the PAP activities.	Woodside relies on existing environmental baseline for receptors which have predicted hydrocarbon contact (above environment threshold) < 10 days and acquiring pre-emptive data in the event of an instantaneous MDO release from the PAP activities based on receptors predicted to have hydrocarbon contact > 10 days. Ensure there is appropriate baseline for key receptors for all geographic locations that are potentially impacted < 10 days of spill event, where practicable. Address resourcing needs to collect pre-emptive baseline as spill expands in the event of an instantaneous marine diesel release from the PAP activities.

6.7.1.3 Improved control measures

Improved control measures considered – No reasonably practicable improved Control Measures identified.

6.7.2 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:
  - Determine baseline data needs and provide implementation plan in the event of an unplanned hydrocarbon release.
- Improved:
  - None selected.

6.7.3 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 (**Section 5** and **ANNEX B**: Operational Monitoring Activation and Termination Criteria**)** to determine receptor locations and receptors at risk. Confirm sensitive receptors likely to be exposed to hydrocarbons, timeframes to specific receptor locations and which SMPs are triggered. Review baseline data for receptors at risk.
Perth ICC Planning (ICC Planning – Environment Unit) (SMP Lead/Manager and SMP Coordinator)	SMP co-ordinator stands up SMP standby contractor as the SMP Contractor. Stands up subject matter experts, if required.
Perth ICC Planning (ICC Planning – Environment Unit) (SMP Lead/Manager SMP Coordinator, SMP Standby Contractor, SMP Manager)	Establish if, and where, pre-contact baseline data acquisition is required. Determines practicable baseline acquisition program based on predicted timescales to contact and anticipated SMP mobilisation times. Determines scope for preliminary post-contact surveys during the Response Phase. Determines which SMP activities are required at each location based on the identified receptor sensitivities.

Responsibility	Action
Perth ICC Planning (ICC Planning – Environment Unit) (SMP Lead/Manager, SMP Coordinator, Standby Contractor, SMP Manager)	If response phase data acquisition is required, stand up the contractor SMP teams for data acquisition and instruct them to standby awaiting further details for mobilisation from the ICC.
Perth ICC Planning (ICC Planning – Environment Unit) (SMP Lead/Manager, SMP Coordinator, SMP Standby Contractor, SMP Manager)	SMP contractor, SMP standby contractor to prepare the Field Implementation Plan. Prepare and obtain sign-off of the Response Phase SMP work plan and Field Implementation Plan. Update the IAP.
Perth ICC Planning (ICC Planning – Environment Unit) (SMP Lead/Manager, SMP Coordinator, SMP Standby Contractor, SMP Manager)	Liaise with ICC Logistics, and determine the status and availability of aircraft, vessels and road transportation available to transport survey personnel and equipment to point of departure. Engage with SMP Standby 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 SMP Operational Plan) • equipment storage and pick-up locations • personnel pick-up/airport departure locations • ports of departure • land based operational centres and forward operations bases accommodation and food requirements.
Perth ICC Planning (ICC Planning – Environment Unit) (SMP Lead/Manager, SMP Coordinator, SMP Standby Contractor, SMP Manager)	Confirm communications procedures between Woodside SMP team, SMP Standby Contractor, SMP Manager, SMP Team Leads and Operations Coordinator (ICC).
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 SMP Contractor, SMP Duty Manager. Agree SMP mobilisation timeline and induction procedures with the Operations Coordinator (ICC).
Perth ICC Logistics	Coordinate with SMP Standby Contractor, SMP Duty Manager to mobilise teams and equipment according to the logistics plan and Sector induction procedures.
SMP Survey Team Leads	SMP Survey Team Leader(s) coordinate on-ground/on-vessel mobilisations and support services with the Operations Coordinator (ICC).

6.7.4 ALARP and Acceptability summary

<table>
<tr><th colspan="3">ALARP and Acceptability Summary</th></tr>
<tr><th colspan="3">Scientific Monitoring</th></tr>
<tr><td rowspan="4">ALARP Summary</td><td>X</td><td>All known reasonably practicable control measures have been adopted</td></tr>
<tr><td>X</td><td>No additional, alternative and improved control measures would provide further benefit</td></tr>
<tr><td>X</td><td>No reasonably practical additional, alternative, and/or improved control measure exists</td></tr>
<tr><td colspan="2">The resulting scientific monitoring capability has been assessed against the combined credible spill scenarios for Scarborough Seabed Intervention and Trunkline Installation activity. The range of strategies provide an ongoing approach to monitoring operations to assess and evaluate the scale and extent of impacts.
All known reasonably practicable control measures have been adopted with the cost and organisational complexity of these options determined to be Moderate and the overall delivery effectiveness considered Medium. The SMP’s main objectives can be met, with the addition of one alternative control measures to provide further benefit.</td></tr>
<tr><td>Acceptability Summary</td><td colspan="2">• The control measures selected for implementation manage the potential impacts and risks to ALARP.
• In the event of a hydrocarbon spill for the PAP, the control measures selected, meet or exceed the requirements of Woodside Management System and industry best-practice.
• Throughout the PAP, relevant Australian standards and codes of practice will be followed to evaluate the impacts from an instantaneous marine diesel release.
• The level of impact and risk to the environment has been considered with regard to the principles of Environmentally Sustainable Development; and risks and impacts from a range of identified scenarios were assessed in detail. The control measures described consider the conservation of biological and ecological diversity, through both the selection of control measures and the management of their performance. The control measures have been developed to account for the combined credible spill scenarios for Scarborough Seabed Intervention and Trunkline Installation activity, and uncertainty has not been used as a reason for postponing control measures.</td></tr>
<tr><td colspan="3">On the basis from the impact assessment above and in Section 6 of the Scarborough Seabed Intervention and Trunkline Installation activity EP, Woodside considers the adopted controls discussed manage the impacts and risks associated with implementing scientific monitoring activities to a level that is ALARP and acceptable.</td></tr>
</table>

7 ENVIRONMENTAL RISK ASSESSMENT OF SELECTED RESPONSE TECHNIQUES

The implementation of response techniques may modify the impacts and risks identified in the EP and response activities can introduce additional impacts and risks from response operations themselves. Therefore, it is necessary to complete an assessment to ensure these impacts and risks have been considered and specific measures are put in place to continually review and manage these further impacts and risks to ALARP and Acceptable levels. A simplified assessment process has been used to complete this task which covers the identification, analysis, evaluation and treatment of impacts and risks introduced by responding to the event.

7.1 Identification of impacts and risks from implementing response techniques

Each of the control measures can modify the impacts and risks identified in the EP. These impacts and risks have been previously assessed within the scope of the EP. Refer to the EP for details regarding how these risks are being managed. They are not discussed further in this document.

- Atmospheric emissions
- Routine and non-routine discharges
- Physical presence, proximity to other vessels (shipping and fisheries)
- Routine acoustic emissions vessels
- Lighting for night work/navigational safety
- Invasive marine species
- Collision with marine fauna
- Disturbance to Seabed

Additional impacts and risks associated with the control measures not included within the scope of the EP include:

- Vessel operations and access in the nearshore environment
- Presence of personnel on the shoreline
- Human presence (manual cleaning)
- Additional stress or injury caused to wildlife
- Secondary contamination from the management of waste

7.2 Analysis of impacts and risks from implementing response techniques

The table below compares the adopted control measures for this activity against the environmental values that can be affected when they are implemented.

Table 7-1: Analysis of risks and impacts

	Environmental Value						
	Soil & Groundwater	Marine Sediment Quality	Water Quality	Air Quality	Ecosystems/ Habitat	Species	Socio-Economic
Monitor and evaluate		✓	✓		✓	✓	
Source control		✓	✓	✓	✓	✓	✓
Shoreline Protection & Deflection	✓	✓	✓		✓	✓	✓
Shoreline Clean-up	✓	✓	✓		✓	✓	✓
Oiled Wildlife					✓	✓	
Scientific Monitoring		✓	✓		✓	✓	✓
Waste Management	✓			✓	✓	✓	✓

7.3 Evaluation of impacts and risks from implementing response techniques

Vessel operations and anchoring

During the implementation of response techniques, where water depths allow, it is possible that response vessels will be required to anchor (e.g. during shoreline surveys). The use of vessel anchoring will be minimal and likely to occur when the impacted shoreline is inaccessible via road. Anchoring in the nearshore environment of sensitive receptor locations will have the potential to impact coral reef, seagrass beds and other benthic communities in these areas. Recovery of benthic communities from anchor damage depends on the size of anchor and frequency of anchoring. Impacts would be highly localised (restricted to the footprint of the vessel anchor and chain) and temporary, with full recovery expected.

Presence of personnel on the shoreline

Presence of personnel on the shoreline during shoreline operations could potentially result in disturbance to wildlife and habitats. During the implementation of response techniques, it is possible that personnel may have minimal, localised impacts on habitats, wildlife and coastlines. The impacts associated with human presence on shorelines during shoreline surveys may include:

- Damage to vegetation/habitat to gain access to areas of shoreline oiling;
- Damage or disturbance to wildlife during shoreline surveys;
- Removal of surface layers of intertidal sediments (potential habitat depletion); and
- Excessive removal of substrate causing erosion and instability of localised areas of the shoreline.

Human presence

Human presence for manual clean-up operations may lead to the compaction of sediments and damage to the existing environment especially in sensitive locations such as mangroves and turtle nesting beaches. However, any impacts are expected to be localised with full recovery expected.

Additional stress or injury caused to wildlife

Additional stress or injury to wildlife could be caused through the following phases of a response:

- Capturing wildlife
- Transporting wildlife
- Stabilisation of wildlife
- Cleaning and rinsing of oiled wildlife
- Rehabilitation (e.g. diet, cage size, housing density)
- Release of treated wildlife

Inefficient capture techniques have the potential to cause undue stress, exhaustion or injury to wildlife, additionally pre-emptive capture could cause undue stress and impacts to wildlife when there are uncertainties in the forecast trajectory of the spill. During the transportation and stabilisation phases there is the potential for additional thermoregulation stress on captured wildlife. Additionally, during the cleaning process, it is important personnel undertaking the tasks are familiar with the relevant techniques to ensure that further injury and the removal of water proofing feathers are managed and mitigated. Finally, during the release phase it’s important that wildlife is not released back into a contaminated environment.

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.

7.4 Treatment of impacts and risks from implementing response techniques

In respect of the impacts and risks assessed the following treatment measures have been adopted. It must be recognised that this environmental assessment is seeking to identify how to maintain the level of impact and risks at levels that are ALARP and of an acceptable level rather than exploring further impact and risk reduction. It is for this reason that the treatment measures identified in this assessment will be captured in Operational Plans, Tactical Response Plans (**ANNEX E**), and/or First Strike 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 (Performance Standard (PS) 8.1, 11.1, 14.1)

- Shallow draft vessels will be used to access remote shorelines to minimise the impacts associated with seabed disturbance on approach to the shorelines (PS 11.2, 14.2)

Presence of personnel on the shoreline

- Oversight by trained personnel who are aware of the risks (PS 14.6)
- Trained unit leader’s brief personnel of the risks prior to operations (PS 14.7)

Human Presence

- Shoreline access route (foot, car, vessel and helicopter) with the least environmental impact identified will be selected by a specialist in shoreline contamination assessment techniques (SCAT) operations (PS 7.3, 14.5)
- Vehicular access will be restricted on dunes, turtle nesting beaches and in mangroves (PS 14.3)

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 16.3)

Waste generation

- All shoreline clean-up sites will be zoned and marked before clean-up operations commence (PS 12.4)
- Removal of vegetation will be limited to moderately or heavily oiled vegetation (PS 14.4).

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.

9 ACCEPTABILITY CONCLUSION

Following the ALARP evaluation process, Woodside deems the hydrocarbon spill risks and impacts to have been reduced to an acceptable level by meeting all of the following criteria:

- Techniques are consistent with Woodside's processes and relevant internal requirements including policies, culture, processes, standards, structures and systems.
- Levels of risk/ impact are deemed acceptable by relevant persons (external stakeholders) and are aligned with the uniqueness of, and/or the level of protection assigned to the environment, its sensitivity to pressures introduced by the activity, and the proximity of activities to sensitive receptors, and have been aligned with Part 3 of the EPBC Act.
- Selected control measures meet requirements of legislation and conventions to which Australia is a signatory (e.g. International Convention for the Prevention of Pollution from Ships (MARPOL), the World Heritage Convention, the Ramsar Convention, and the Biodiversity Convention etc.). In addition to these, other non-legislative requirements met include:
    - Australian IUCN reserve management principles for Commonwealth marine protected areas and bioregional marine plans.
    - National Water Quality Management Strategy and supporting guidelines for marine water quality).
    - Conditions of approval set under other legislation.
    - National and international requirements for managing pollution from ships.
    - National biosecurity requirements.
- Industry standards, best practices and widely adopted standards and other published materials have been used and referenced when defining acceptable levels. Where these are inconsistent with mandatory/ legislative regulations, explanation has been provided for the proposed deviation. Any deviation produces the same or a better level of environmental performance (or outcome).

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11 GLOSSARY & ABBREVIATIONS

11.1 Glossary

Term	Description / Definition
ALARP	Demonstration through reasoned and supported arguments that there are no other practicable options that could reasonably be adopted to reduce risks further.
Availability	The availability of a control measure is the percentage of time that it is capable of performing its function (operating time plus standby time) divided by the total period (whether in service or not). In other words, it is the probability that the control has not failed or is undergoing a maintenance or repair function when it needs to be used.
Control	The means by which risk from events is eliminated or minimised.
Control effectiveness	A measure of how well the control measures perform their required function.
Control measure (risk control measure)	The features that eliminate, prevent, reduce or mitigate the risk to environment associated with PAP.
Credible spill scenario	A spill considered by Woodside as representative of maximum volume and characteristics of a spill that could occur as part of the PAP.
Dependency	The degree of reliance on other systems in order for the control measure to be able to perform its intended function.
Environment that may be affected	The summary of quantitative modelling where the marine environment could be exposed to hydrocarbons levels exceeding hydrocarbon threshold concentrations.
Incident	An event where a release of energy resulted in or had 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 (World Heritage Area, WHA, Commonwealth or State marine reserve or park) containing one or more receptor type.

Term	Description / Definition
Receptor Sensitivities	This is a classification scheme to categorise receptor sensitivity to an oil spill. The Environmental Sensitivity Index (ESI) is a numerical classification of the relative sensitivity of a particular environment (particularly different shoreline types) to an oil spill. Refer to the Woodside 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	Measures taken in response to an event to reduce or prevent adverse consequences. Response techniques are selected to achieve an effective response that meets incident objectives. Response techniques are selected according to the specific conditions and environment of the event.
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 (ZoA)	The zone in which Woodside may elect to apply dispersant. The zone is determined based on a range of considerations, such as hydrocarbon characteristics, weathering and metocean conditions. The zone is a key consideration in the Net Environmental Benefit Analysis for dispersant use.

11.2 Abbreviations

Abbreviation	Meaning
AHV	Anchor Handler Vessel
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
API	American Petroleum Institute
APPEA	Australian Petroleum Production & Exploration Association
AUV	Autonomous Underwater Vehicle
BAOAC	Bonn Agreement Oil Appearance Code
BOPE	Blowout Preventer Equipment
CEDRE	Centre of Documentation, Research and Experimentation
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CICC	Corporate Incident Coordination Centre
CMT	Crisis Management Team
COP	Common Operating Picture
CS	Credible Scenario
DBCA	Department of Biodiversity, Conservation and Attractions (former Department of Parks and Wildlife)
DM	Duty Manager
DNA	Deoxyribonucleic Acid
DoT	Department of Transport
DP	Dynamically Positioned
EMBA	Environment that May Be Affected
EMSA	European Maritime Safety Agency
EP	Environment Plan
EPBC	Environment Protection and Biodiversity Conservation
EROD	ethoxyresorufin-O-deethylase
ESI	Environmental Sensitivity Index
ESD	Environmentally Sustainable Development
ESP	Environmental Services Panel
FSP	First Strike Plan
FST	Functional Support Team
GIS	Geographic Information System
GSI	Gonadosomatic Index
HSE	Health Safety and Environment
HSEQ	Health Safety Environment and Quality
HSP	Hydrocarbon Spill Preparedness

Abbreviation	Meaning
IAP	Incident Action Plan
I&CM	Incident and Crisis Management
IC	Incident Controller
ICC	Incident Coordination Centre
ICE	Internal Control Environment
ID	Identification
IGEM	Industry-Government Environmental Meta-database
IMIS	Incident Management Information System
IMS	Incident Management System
IMO	International Marine Organisation
IMT	Incident Management Team
IPIECA	International Petroleum Industry Environment Conservation Association
IR	Infrared
ISV	Infield Support Vessels
ITOPF	International Tanker Owners Pollution Federation
IUCN	International Union for Conservation of Nature
KBSB	King Bay Support Base
KGP	Karratha Gas Plant
LEL	Lower Explosive Limit
LSI	Liver Somatic Index
MARPOL	International Convention for the Prevention of Pollution from Ships
MoU	Memorandum of Understanding
MSRC	Marine Spill Response Corporation
NATA	National Association of Testing Authorities
NEBA	Net Environmental Benefit Analysis
NOAA	National Oceanic and Atmospheric Administration
NOPSEMA	National Offshore Petroleum Safety and Environmental Management Authority
NRDA	Natural Resource Damage Assessment
NWBM	Non-Water Based Muds
OIE	Offset Installation Equipment
OILMAP	Oil Spill Model and Response System
OM	Operational Monitoring
OMP	Operational Monitoring Program
OPEA	Oil Pollution Emergency Arrangements
OPEP	Oil Pollution Emergency Plan
OPGGS	Offshore Petroleum and Greenhouse Gas Storage
OSPRMA	Oil Spill Preparedness and Response Mitigation Assessment
OSRL	Oil Spill Response Limited

Abbreviation	Meaning
OSRO	Oil Spill Response Organisation
OSTM	Oil Spill Trajectory Modelling
OWR	Oiled Wildlife Response
OWRP	Oiled Wildlife Response Plan
OWROP	Oiled Wildlife Response Operational Plan
QA/QC	Quality Assurance/Quality Control
PAH	Polyaromatic Hydrocarbon
PAP	Petroleum Activities Program
PBA	Pre-emptive Baseline Areas
PPB	Parts per billion
PS	Performance Standard
PS&BR	Property, Security and Business Resilience
ROV	Remotely Operated Vehicle(s)
RPA	Response Protection Area
S&EM	Security and Emergency Management
SCAT	Shoreline Contamination Assessment Techniques
SDH	Sorbitol Dehydrogenase
SIMAP	Spill Impact Mapping and Analysis Program
SIMOPS	Simultaneous Operations
SME	Subject Matter Expert
SMP	Scientific Monitoring Program
SOPEP	Ship Oil Pollution Emergency Plan
SPD	Shoreline Protection and Deflection
SQGV	Sediment Quality Guideline Values
TOA	Testing of Arrangements
TRP	Tactical Response Plan
TRSV	Tubing Retrievable Safety Valve
TSS	Total Suspended Solids
UV	Ultraviolet
WA DoT	Western Australia Department of Transport
WBM	Water Based Muds
WCCS	Worst Case Credible Scenario
WHA	World Heritage Area
WMS	Woodside Management System
WiRCs	Woodside Integrated Risk & Compliance System
WEL/ Woodside	Woodside Energy Limited
WWCI	Wild Well Control Inc
ZoA	Zone of Application

ANNEX A: NET ENVIRONMENTAL BENEFIT ANALYSIS DETAILED OUTCOMES

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 marine diesel (representing platform surface release during operations). The locations utilised for the NEBA were limited to the identified RPAs of the PAP identified from modelling. These include receptors which have potential for the following:

- Surface contact (>50 g/m²)
- Shoreline accumulation (100 g/m²)
- Entrained contact (>100 ppb and <14 days)

The detailed NEBA assessment outcomes are available via this Link.

Table A-1: NEBA assessment technique recommendations for marine diesel

Receptor	Contact	Monitor and Evaluate	Source control via vessel SOPEP	Dispersant application: > 20 m water depth and > 10 km from shore/reefs	Mechanical dispersion	In situ burning	Containment and Recovery	Shoreline protection	Shoreline clean-up (manual)	Shoreline clean-up (mechanical)	Shoreline clean-up (chemical)	Oiled Wildlife Response
Open Commonwealth waters (Operational Area)	>50 g/m² surface >100 ppb entrained	Yes	Yes	No	No	No	No	No	No	No	No	Yes
Dampier Archipelago	>100 g/m² shoreline >50 g/m² surface >100 ppb entrained	Yes	Yes	No	No	No	No	Yes	Yes	No	No	Yes
Muiron Islands, Muiron Islands MMA-WHA	>100 ppb entrained	Yes	Yes	No	No	No	No	Potentially	Potentially	No	No	Yes
Pilbara - Middle Pilbara – Islands & Shoreline	>100 ppb entrained	Yes	Yes	No	No	No	No	Potentially	Potentially	No	No	Yes
Pilbara Islands – Southern Island Group	>100 ppb entrained	Yes	Yes	No	No	No	No	Potentially	Potentially	No	No	Yes
Montebello Marine Park	>100 ppb entrained	Yes	Yes	No	No	No	No	Potentially	No	No	No	Yes
Montebello State Marine Park	>100 ppb entrained	Yes	Yes	No	No	No	No	No	No	No	No	Yes
Montebello Islands	>100 ppb entrained	Yes	Yes	No	No	No	No	Potentially	Potentially	No	No	Yes
Dampier Marine Park	>100 ppb entrained	Yes	Yes	No	No	No	No	No	No	No	No	Yes
Gascoyne Marine Park	>100 ppb entrained	Yes	Yes	No	No	No	No	No	No	No	No	Yes
Barrow Island	>100 ppb entrained	Yes	Yes	No	No	No	No	Potentially	Potentially	No	No	Yes
Ningaloo Coast North and WHA, Ningaloo RUZ	>100 ppb entrained	Yes	Yes	No	No	No	No	Potentially	Potentially	No	No	Yes
Rankin Bank	>100 ppb entrained	Yes	Yes	No	No	No	No	No	No	No	No	Yes
Lowendal Islands	>100 ppb entrained	Yes	Yes	No	No	No	No	Potentially	Potentially	No	No	Yes

Overall assessment

Sensitive receptor (Sites identified in EP)	Monitor and Evaluate	Source control via vessel SOPEP	Dispersant application: > 20 m water depth and > 10 km from shore/reefs	Mechanical dispersion	In situ burning	Containment and Recovery	Shoreline protection	Shoreline clean-up (manual)	Shoreline clean-up (mechanical)	Shoreline clean-up (chemical)	Oiled Wildlife Response
Is this response Practicable?	Yes	Yes	No	No	No	No	Potentially	Potentially	No	No	Yes
NEBA identifies Response potentially of Net Environmental Benefit?	Yes	Yes	No	No	No	No	Potentially	Potentially	No	No	Yes

NEBA Impact Ranking Classification Guidance

To reduce variability between assessments, the following ranking descriptions have been devised to guide the workshop process:

			Degree of impact [16]	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))

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[16] NOTE: the maximum likely impact should be considered; for example, if a spill were to directly impact the behaviour that results in an impact to reproduction and/or the breeding population (such as fish failing to aggregate to spawn), then the score should be a 2 or 3 rather than a 1. Similarly, if a change in behaviour resulted in an increased risk of mortality of a population, then it should be scored as a 2 or 3

ANNEX B: OPERATIONAL MONITORING ACTIVATION AND TERMINATION CRITERIA

Table B-1: Operational monitoring objectives, triggers and termination criteria

Operational Monitoring Operational Plan	Objectives	Activation triggers	Termination criteria
Operational Monitoring Operational Plan 1 (OM01) Predictive Modelling of Hydrocarbons to Assess Resources at Risk	OM01 focuses on the conditions that have prevailed since a spill commenced, as well as those that are forecasted in the short term (1–3 days ahead) and longer term. OM01 utilises computer-based forecasting methods to predict hydrocarbon spill movement and guide the management and execution of spill response operations to maximise the protection of environmental resources at risk. The objectives of OM01 are to: • Provide forecasting of the movement and weathering of spilled hydrocarbons • Identify resources that are potentially at risk of contamination • Provide simulations showing the outcome of alternative response options (booming patterns etc.) to inform on-going Net Environmental Benefit Analysis (NEBA) and continually assess the efficacy of available response options in order to reduce risks to ALARP	OM01 will be triggered immediately following a level 2/3 hydrocarbon spill.	The criteria for the termination of OM01 are: • The hydrocarbon discharge has ceased • Response activities have ceased • Hydrocarbon spill modelling (as verified by OM02 surveillance observations) predicts no additional natural resources will be impacted

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.

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)

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.

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.

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.

Role	Location	Responsibility
Environmental Service Provider Roles		
SMP standby contractor: SMP Duty Manager/Project Manager	Onshore (Perth)	• Coordinates the delivery of the SMPs • Provides costings, schedule and progress updates for delivery of SMPs • Determines the structure of the Environmental Service Provider's team to necessitate delivery of the SMPs • Verifies that HSE Plans, detailed sampling plans and other relevant deliverables are developed and implemented for delivery of the SMPs • Directs field teams to deliver SMPs • Arranges all contractual matters, on behalf of Environmental Service Provider, associated with the delivery of the SMPs to Woodside • Manages sub-consultant delivery to Woodside • Provides required personnel and equipment to deliver the SMPs
SMP Field Teams	Offshore – Monitoring Locations	• Delivers the SMPs in the field consistent with the detailed sampling plans and HSE requirements, within time and budget. • Early communication of time, budget, HSE risks associated with delivery of the SMPs to the Environmental Service Provider – Project Manager • Provides start up, progress and termination updates to the Environmental Service Provider – Project Manager (will be led in-field by a party chief).

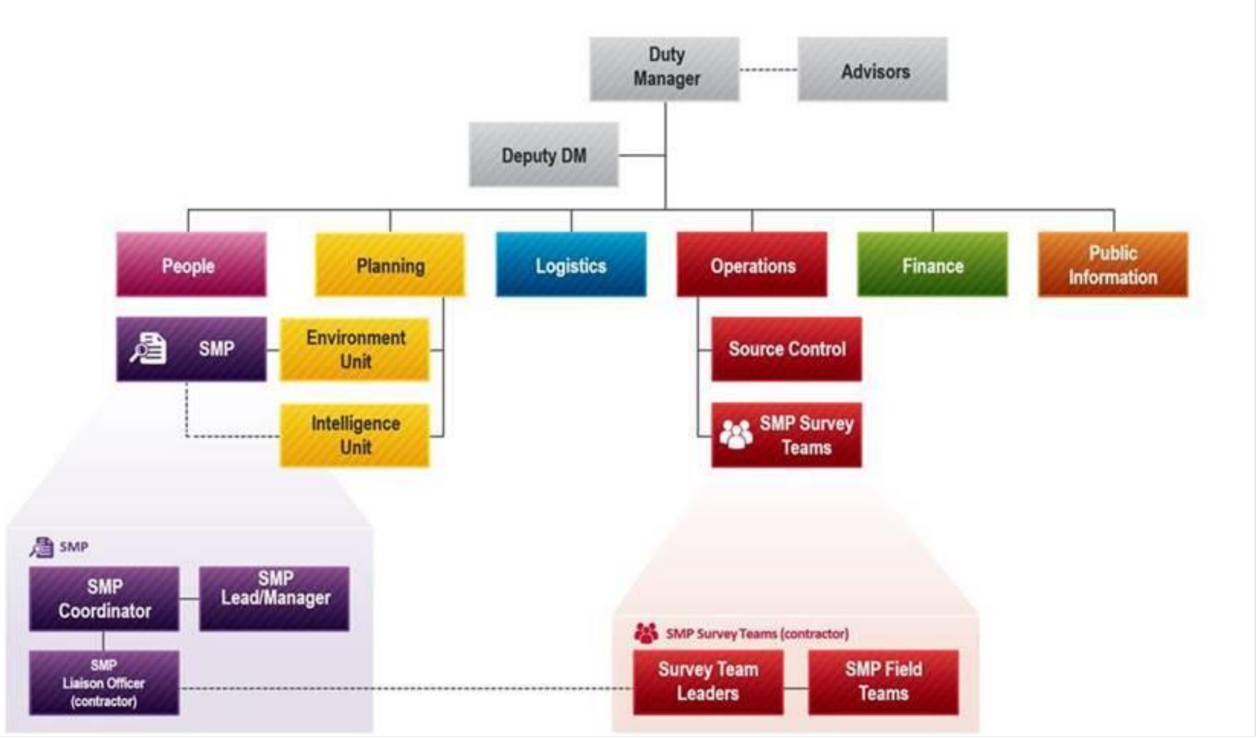

Figure C-1: Woodside Oil Spill Scientific Monitoring Program Delivery Team and Linkage to Incident Control Centre (ICC) organisational structure.

Table C-2: Oil Spill Environmental Monitoring: Scientific Monitoring Program - Objectives, Activation Triggers and Termination Criteria

Scientific monitoring Program (SMP)	Objectives	Activation Triggers	Termination Criteria
Scientific monitoring program 1 (SM01) **Assessment of Hydrocarbons in Marine Waters**	SM01 will detect and monitor the presence, extent, persistence and properties of hydrocarbons in marine waters following the spill and the response. The specific objectives of SM01 are as follows: • Assess and document the extent, severity and persistence of hydrocarbon contamination with reference to observations made during surveillance activities and / or in-water measurements made during operational monitoring; and • Provide information that may be used to interpret potential cause and effect drivers for environmental impacts recorded for sensitive receptors monitored under other SMPs.	SM01 will be initiated in the event of a Level 2 or 3 hydrocarbon release, or any release event with the potential to contact sensitive environmental receptors	SM01 will be terminated when: • Operational monitoring data relating to observations and / or measurements of hydrocarbons on and in water have been compiled, analysed and reported; and • The report provides details of the extent, severity and persistence of hydrocarbons which can be used for analysis of impacts recorded for sensitive receptors monitored under other SMPs. SMP monitoring of sensitive receptor sites: • Concentrations of hydrocarbons in water samples are below NOPSEMA guidance note (2019[17]) 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[18]) 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.

[17] NOPSEMA (2019) Bulletin #1 – Oil spill modelling – April 2019, https://www.nopsema.gov.au/assets/Bulletins/A652993.pdf
[18] Simpson SL, Batley GB and Chariton AA (2013). Revision of the ANZECC/ARMCANZ Sediment Quality Guidelines. CSIRO and Water Science Report 08/07. Land and Water, pp. 132.

Scientific monitoring Program (SMP)	Objectives	Activation Triggers	Termination Criteria
		• 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.

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.

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 Environment Protection and Biodiversity Conservation (EPBC) Act) potentially exposed to hydrocarbons. With the first 24-48 hours of a spill event, such information will be sourced and evaluated as part of the SMP planning process guided by Appendix D (identified receptors vulnerable to hydrocarbon contact), the information presented in the Existing Environment section of the EP as well as other information sources such as the Woodside Baseline Environmental Studies Database.

The starting point for decision-making on 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 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. 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).

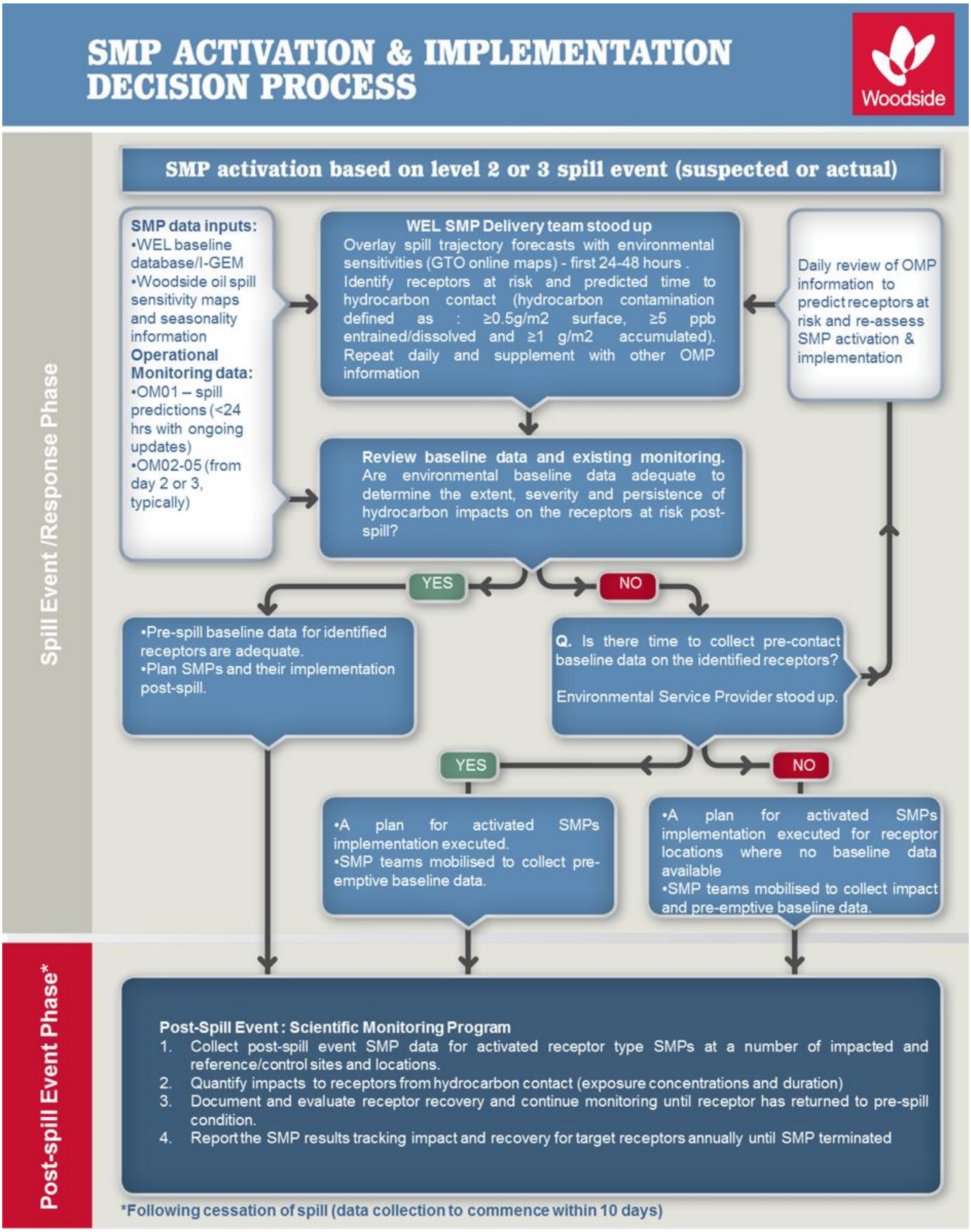

Figure C-2: Activation and Implementation Decision-tree for Oil Spill Environmental Monitoring

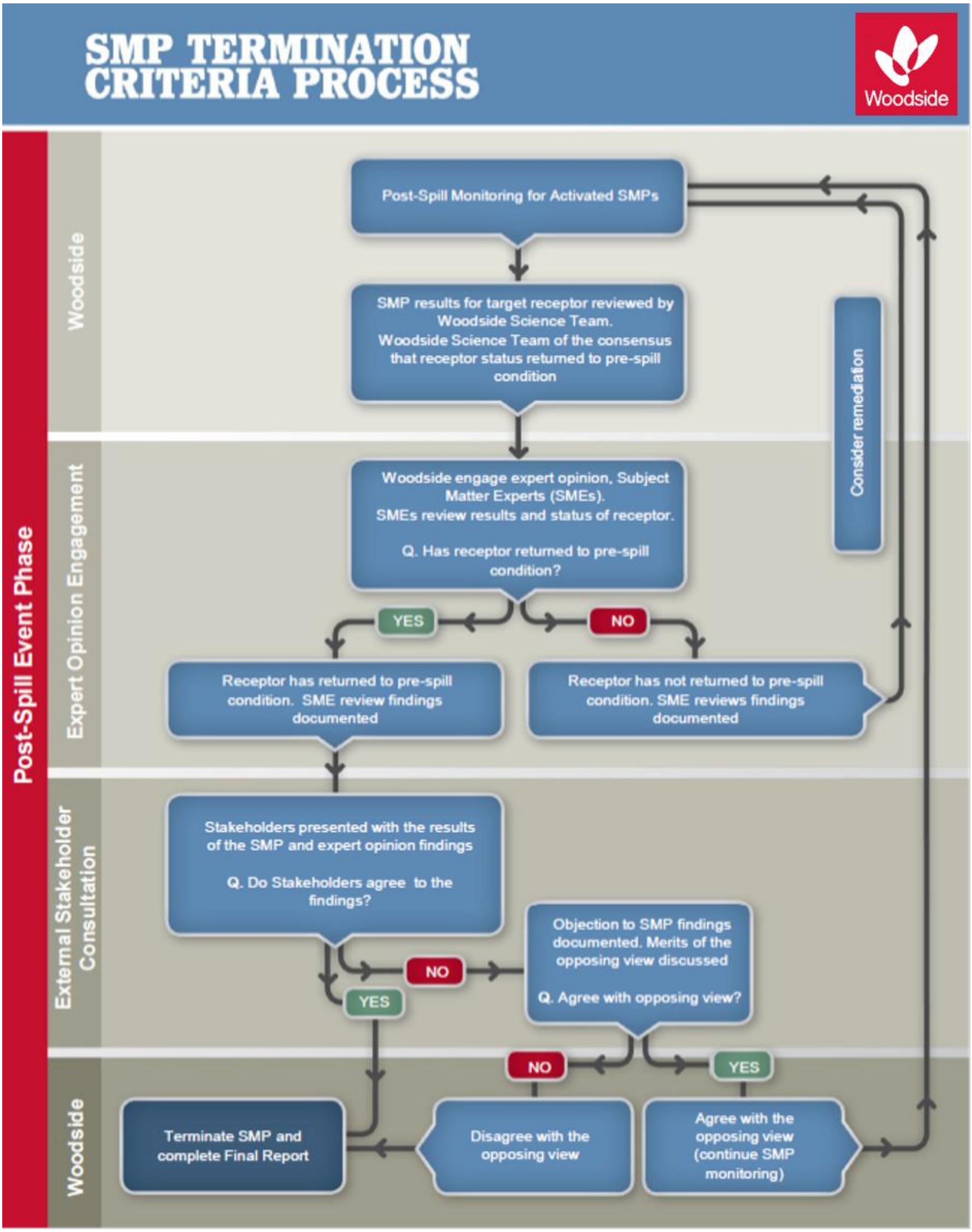

Figure C-3: Termination Criteria Decision-tree for Oil Spill Environmental Monitoring

Receptors at Risk and Baseline Knowledge

In order to assess the baseline studies available and suitability for oil spill scientific monitoring, Woodside maintains knowledge of environmental baseline studies through the upkeep and use of its Environmental Knowledge Management System.

Woodside's Environmental Knowledge Management System is a centralised platform for scientific information on the existing environment, marine biodiversity, Woodside environmental studies, key environmental impact topics, key literature and web-based resources. The system comprises a number of data directories and an environmental baseline database, as well as folders within the 'Corporate Environment' server space. The environmental baseline database was set up to support Woodside's SMP preparedness and as a SMP resource in the event of an unplanned hydrocarbon spill. The environmental baseline database is subject to updates including annual reviews completed as part of 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)[19] 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, Quality Assurance/Quality Control (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.

[19] https://biocollect.ala.org.au/imsa#max%3D20%26sort%3DdateCreatedSort

ANNEX D: MONITORING PROGRAM AND BASELINE STUDIES FOR THE PETROLEUM ACTIVITIES PROGRAM

Table D-1: Oil Spill Environmental Monitoring – scientific monitoring program scope for the Petroleum Activities Program based on Worst Case Credible Spill EMBA (based three modelled marine diesel scenarios)

		Receptor Areas - Potential Impact and Reference Scientific Monitoring Sites (marked X)																																							
Receptors to be Monitored	Applicable SMP	Kimberley AMP	Agro-Rowley Terrace AMP	Montebello AMP	Dampier AMP	Carnarvon Canyon AMP	Ningaloo AMP	Gascoyne AMP	Shark Bay Open Ocean (including AMP)	Abrolhos AMP	Jurien AMP	Two Rocks AMP	Perth Canyon AMP	Geographe AMP	South-west Corner AMP	Ashmore Reef and AMP	Seringapatam Reef	Scott Reef (North and South)	Mermaid Reef and AMP	Clerke Reef and State Marine Park	Imperieuse Reef and State Marine Park	Rankin Bank	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 – Middle and 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)	Dampier Archipelago
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			X
Mangroves and Saltmarsh	SM04																											X						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	X
Pinnipeds (significant colonies / haul-out sites)	SM07									X	X	X			X																										
Cetaceans - Migratory Whales	SM08	X	X	X	X		X	X	X	X	X	X	X	X	X			X									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	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	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	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

(dark red)	Receptor areas identified as Pre-emptive Baseline Areas (based on criteria of surface contact and/or entrained hydrocarbon contact ≤10 days (Offshore Australian Marine Parks contacted by hydrocarbons in this timeframe also noted)
(light red)	Receptor areas identified as Pre-Emptive Basline Areas in the response phase >10 days (based on criteria of surface contact and/or entrained hydrocarbon contact >10 days)
(white)	Receptor areas that may be identified as impact or reference sites in the event of major hydrocarbon release and would be identified as part of the SMP planning process

Table D-2: Baseline Studies for the SMPs applicable to identified Pre-emptive Baseline Areas for the Petroleum Activities Program

Major Baseline	Proposed Scientific monitoring operational plan and Methodology	Rankin Bank & Glomar Shoal	Montebello Islands	Barrow Island	Lowendal Islands	Pilbara Islands – Southern Island Group (Serrurier, Thevenard and Bessieres Islands – State Nature Reserve)	Montebello AMP	Ningaloo and the Muiron Islands	Dampier Archipelago
Benthic Habitat (Coral Reef)	**SM03**	**Studies:**							
	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 Shoal 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 Shoal and Rankin Bank surveys, 2017. GWF-2 Monitoring Programme. Quantitatively surveyed benthic habitats and communities. 4. Temporal Studies survey of Rankin Bank and Glomar Shoal, 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.	1. DBCA LTM Ningaloo Reef program: 1991-ongoing 2. AIMS/DBCA 2014 Baseline Ningaloo and Muiron Islands Survey – repeat and expansion on the LTM (Co-funded survey: Woodside and AIMS). 3. Pilbara Marine Conservation Partnership. 4. WAMSI LTM Study: Ningaloo Research node: 2009 -10 over the length of Ningaloo reef system (with a focus on coral and fish recruitment). 5. Ningaloo Outlook (CSIRO) - Shallow and Deep Reefs Program (2015-ongoing). 6. Ningaloo Collaboration Cluster: Habitats of the Ningaloo Reef and adjacent coastal areas determined through hyperspectral imagery.	1. Coral Monitoring, Mermaid Sound. URS on behalf of Chevron, 2004. 2. Pluto baseline marine habitat surveys 2007 – 2008. 3. Pluto dredge and post dredge monitoring 2008-2010. 4. Benthic habitat survey at the Eastern Flank Development area commissioned by Woodside. 5. Benthic community monitoring as part of DBCA's Dampier Archipelago Marine Monitoring Program (2007-ongoing). 6. WA Museum study on the Scleractinian corals collected in 1998. (Griffith 2004). 7. Pilbara Marine Conservation Partnership Seabed biodiversity survey (2013). 8. Coral recruitment in the Northern Pilbara (2015 and 2016). 9. Distribution, patterns and key processes of major marine communities and large marine fauna – DBCA Pluto Offset Program (of the proposed Dampier Archipelago Marine Park and Cape Preston Marine Management Area). 10. Establishment of long-term monitoring reference sites in the Pluto Offset program with DBCA (proposed Dampier Archipelago Marine Park and Cape Preston Marine Management Area). 11. Study of the spatial and temporal distribution of coral assemblages at Dampier Archipelago (Cape Preston to Delambre Island), using 871 datasets dating back to the early 1970s. Sites surveyed in May 2017.
		Methods:							

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	Ningaloo and the Muiron Islands	Dampier Archipelago
		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.	1. LTM transects, diver based (video) photo quadrats, specimen collection. 2. LTM sites, transects, diver-based video quadrat. 3. Diver video transects, still photography, video and in situ visual estimates from transects, quadrats, manta-tows, towed video and ROV. 4. Video point intercept transects recorded by towed video or diver hand-held video camera. 5. Video transects. 6. LTM transects, diver based (video) photo quadrat.	1. Towed Video. 2. Multibeam hyperspectral, Diver swum surveys, drop camera. 3. Diver swum – belt transects, photo quadrats. 4. Drop camera. 5. Diver swum – belt transects, photo quadrats. 6. Coral collection for taxonomic records. 7. Towed video, benthic trawl and sled. 8. Coral settlement tiles. 9. Collection of fish, coral, mangrove and seagrass samples from reefs along the WA coast, including reefs within the proposed Dampier Archipelago Marine Park. Samples subject to genetic testing. 10. The major datasets collected in 2016/17 were for mangroves, seagrass, macroalgae, coral and fish communities. Monitoring of coral and fish communities undertaken using LIT and UVC methods. with all 15 sites visited and surveyed for the second time in this project. four permanent temperature loggers were exchanged on two occasions, November and May, and a full year of data was downloaded. 11. Photo quadrants and recruitment tiles
		References and Data:							

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	Ningaloo and the Muiron Islands	Dampier Archipelago
		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: DBCA. 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	1. DBCA unpublished data. DATAHOLDER: DBCA 2. AIMS 2015. DATAHOLDER: AIMS. 3. Pilbara Marine Conservation Partnership DATAHOLDER: CSIRO 4. Depczynski et al. 2011 DATAHOLDER: AIMS, DBCA and WAMSI. 5. CSIRO 2019 – Ningaloo Outlook Program 6. Murdoch University - Kobryn et al 2011 and Keulen & Langdon 2011.	1. URS Australia Pty Ltd. 2004. DATAHOLDER: Woodside. 2. SKM, 2008. DATAHOLDER: Woodside, SKM. 3. MSCIENCE, 2010. DATAHOLDER: MSCIENCE. 4. Woodside 2012. DATAHOLDER: Woodside. 5. DBCA. 6. Griffith (2004) Western Australian Museum. 7. CSIRO (2013). DATAHOLDER: Roland Pitcher. 8. CSIRO (2015 and 2016). 9. DBCA (2017) 10. DBCA (2017) 11. Moustaka, et al. 2019 Dataholder: DBCA
Benthic Habitat (Seagrass and Macro-algae)	**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 Shoal 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 Shoal and Rankin Bank surveys, 2017. GWF-2 Monitoring Programme. Quantitatively surveyed benthic habitats and communities. 4. Temporal Studies survey of Rankin Bank and Glomar Shoal, 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	1. Quantitative descriptions of Ningaloo sanctuary zones habitats types including lagoon and offshore areas – Cassata and Collins (2008). 2. CSIRO/BHP Ningaloo Outlook Program. 3. Ningaloo Collaboration Cluster: Habitats of the Ningaloo Reef and adjacent coastal areas determined through hyperspectral imagery. 4. Australian Institute of Marine Science – CReefs: Ningaloo Reef Biodiversity Expeditions (2008-2010).	1. Benthic habitat onitoring, Mermaid Sound by URS on behalf of Chevron. 2. Pluto baseline marine habitat surveys 2007 – 2008. 3. West Australian Museum marine biodiversity collection. 5. Benthic community monitoring as part of DBCA's Dampier Archipelago Marine Monitoring Program (2007-ongoing). 6. Pilbara Marine Conservation Partnership Seabed biodiversity survey (2013). 7. Distribution, patterns and key processes of major marine communities and large marine fauna (Pluto Offset Program DBCA) 8. Establishment of long-term monitoring reference sites for the Pluto Offset Program – DBCA (in the proposed Dampier Archipelago Marine Park and Cape Preston Marine Management Area).
		Methods:							

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	Ningaloo and the Muiron Islands	Dampier Archipelago
		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	1. Video transects to ground truth aerial photographs and satellite imagery. 2. Diver video transects. 3. LTM transects, diver based (video) photo quadrat. 4. LTM transects, diver based (video) photo quadrats, specimen collection.	1. Towed Video. 2. Multi-beam hyperspectral, Diver swum surveys, drop camera. 3. Diving collection to establish diversity, distribution and abundance of biota. 5. Diver swum – belt transects, photo quadrats. 6. Towed video, benthic trawl and sled. 7. Collection of fish, coral, mangrove and seagrass samples from reefs along the WA coast, including reefs within the proposed Dampier Archipelago Marine Park. Samples subject to genetic testing. 8. The major datasets collected in 2016/17 were for mangroves, seagrass, macroalgae, coral and fish communities. Several techniques were trialled for both seagrass and macroalgae monitoring; including benthic imagery, quadrat counts, line intercept measures, and laboratory analysed collections.
		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	1. Cassata and Collins 2008. DATAHOLDER: Curtin University – Applied Geology. 2. CSIRO – Ningaloo Outlook Program 3. Murdoch University - Kobryn et al 2011 and Keulen and Langdon 2011. 4. AIMS (2010) - http://www.aims.gov.au/creefs	1. URS Australia Pty Ltd. 2005. DATAHOLDER: Woodside. 2. SKM, 2008. DATAHOLDER: Woodside, SKM. 3. West Australian Museum 2002. DATAHOLDER: WAM, Woodside. 4. Keesing et. Al. 2011 5.DBCA. 6. Towed video, benthic trawl and sled. 7. DBCA (2017) 8. DBCA (2017)
	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	Ningaloo and the Muiron Islands	Dampier Archipelago
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 Shoal 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 Shoal and Rankin Bank surveys, 2017. GWF-2 Monitoring Programme. Quantitatively surveyed benthic habitats and communities. 4. Temporal Studies survey of Rankin Bank and Glomar Shoal, 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	1. WAMSI 2007 deep-water Ningaloo benthic communities' study, Colquhoun and Heyward (2008). 2. CSIRO/BHP Ningaloo Outlook Program - Deep reef themes 2020	1. Baseline Marine Habitat Survey for the Pluto LNG Project. A total of 315 km2 of Mermaid Sound was mapped in high resolution to distinguish habitat location and extent and further verified with 389 km of towed video.
		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	1. Towed video and benthic sled (specimen sampling). 2. Side-scan sonar and AUV transects.	1. Drop camera surveys of Deepwater sites (approx. 10 – 35 m depth).
		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	1.Colquhoun and Heyward (eds) 2008. DATAHOLDER: WAMSI, AIMS. 2.CSIRO – Ningaloo Outlook 2020	1. SKM 2008. DATAHOLDER: Woodside.
	SM04	**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	Ningaloo and the Muiron Islands	Dampier Archipelago
Mangroves and Saltmarsh	Aerial photography and satellite imagery will be used in conjunction with field surveys to map the range and distribution of mangrove communities.	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	1.Atmospheric correct and land cover classification, NW Cape. 2.Woodside hold Rapid Eye imagery of the Ningaloo Reef and coastal area. 3.Hyperspectral survey (2006) of Ningaloo Reef and coastal area (not yet analysed for Mangroves). 4.North West Cape sensitivity mapping 2012 included Mangrove Bay. 5.Global mangrove distribution as mapped by the USGS and located on UNEP's Ocean Data viewer.	1. Woodside hold Rapid Eye imagery of the Reef and coastal area (2011) 2. Chemical and Ecological Monitoring in Mermaid Sound, 1985 – 2021 3. Woodside Mangrove Habitat Distribution in Mermaid Sound, Dampier Archipelago - 2004. 4. Distribution, patterns and key processes of major marine communities and large marine fauna – Pluto Offset Program DBCA (of the proposed Dampier Archipelago Marine Park and Cape Preston Marine Management Area). 5. Establishment of long-term monitoring reference sites – Pluto Offset Program DBCA (in the proposed Dampier Archipelago Marine Park and Cape Preston Marine Management Area). 6. Lymburner et al. (2019) applies quantitative analysis to assess the extent and canopy density of mangroves for each year between 1987 and 2018 7. Mangrove baseline data 2017 - Woodside has acquired satellite imagery of coastal areas of mainland and offshore islands from Geraldton and the Abrolhos Islands (in the south) to Dampier Archipelago (out to the Montebello Islands in the north), land classification completed and mangrove habitats identified and mapped
		Methods:							

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	Ningaloo and the Muiron Islands	Dampier Archipelago
		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	1. Modular Inversion Program. May 2017 2. Rapid Eye imagery – High resolution satellite imagery from October/November/December 2011 and 2017. 3. Remote sensing – acquisition of HyMap airborne hyperspectral imagery and ground truthing data collection. 4. Reconnaissance surveys of the shorelines of the North West Cape and Muiron Islands. 5. Remote sensing study of global mangrove coverage.	1. Rapid Eye imagery – High resolution satellite imagery from October/November/December 2011. 2. Mangrove canopy cover, phenology, photography, vegetation descriptions. 3. Aerial photography to identify coverage of mangrove habitat in the area. 4. Collection of fish, coral, mangrove and seagrass samples from reefs along the WA coast, including reefs – Pluto Offset Program DBCA (within the proposed Dampier Archipelago Marine Park. Samples subject to genetic testing). 5. The major datasets collected in 2016/17 were for mangroves, seagrass, macroalgae, coral and fish communities. Mangrove communities were monitored using two discreet methods. Mangrove extent was analysed using satellite imagery and this was then verified in the field. Quantitative data was also collected for mangrove health at nine sites; this included density, diversity, recruitment, tree size, height and canopy cover. 6. PCC% for mangroves using optical and radar data (Landsat sensor spectral composite data (all spectral wavebands) and Advanced Land Observing Satellite (ALOS) Phased Arrayed L-band Synthetic Aperture Radar (SAR) data). for the entire Australian coastline. 7. Land cover classification was performed based on atmospherically corrected Sentinel-2 data
		References and Data:							

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	Ningaloo and the Muiron Islands	Dampier Archipelago
		N/A – See Table D-1	1. EOMAP, 2017 DATAHOLDER: Woodside. 2.DBCA unpublished data. DATAHOLDER: DBCA. 3. Voga unpublish data DATAHOLDER: Voga Contact: [redacted] 4. 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	1. EOMAP 2017 DATAHOLDER: Woodside. 2. AAM 2014. Dataholder: Woodside 3. Kobryn et al. 2013. DATAHOLDER: Murdoch University, AIMS; Woodside. 4. Joint Carnarvon Basin Operators, 2012. DATAHOLDER: Woodside and Apache Energy Ltd. 5. http://data.unep-wcmc.org/	1. AAM 2012. DATAHOLDER: Woodside. 2. URS 2013. DATAHOLDER: URS, Woodside. 3. Woodside 2004. 4. DBCA (2017) 5. DBCA (2017) 6. Lymburner et al. 2019. DATAHOULDER: Geoscience Australia, Author ([redacted]) 7. SOURCE: EOMAP 2017 report to Woodside
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.	1. LTM Study of marine and shoreline birds: 1970-2011. 2. LTM of shorebirds within the Ningaloo coastline (Shorebirds 2020). 3. Exmouth Sub-basin Marine Avifauna Monitoring Program (Quadrant Energy/Santos). 4. Seabird and Shorebird baseline studies, Ningaloo Region – Report on January 2018 bird surveys. 5.Wedge-tailed shearwater foraging behaviour in the Exmouth Region – Final Report	1. Baseline information in the Pilbara oiled wildlife response plan 2014. 2. Advisian (2021) NMWR Seabird and Shorebird baseline review (Woodside report)
		Methods:							

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	Ningaloo and the Muiron Islands	Dampier Archipelago
		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. Burrow scopes, 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 surveys and onshore island surveys.	N/A	1. Counts of nesting areas, counts of intertidal zone during high tide. 2. The Shorebirds 2020 database comprises the most complete shorebird count data available in Australia. The data have been collected by volunteer counters and BirdLife Australia staff for approximately 150 roosting and feeding sites, mainly in coastal Australia. The data go back as far as 1981 for key areas. 3. The Exmouth Sub-basin Marine Avifauna Monitoring Program undertook a detailed assessment of seabird and shorebird use in the Exmouth Sub-basin. Four aerial surveys and four island surveys were conducted between February 2013 and January 2015 for this Program, inclusive of the mainland coasts, of shore islands and a 2,500 km^2 area of ocean adjacent to the Exmouth Sub-basin. 4.Shorebird counts, Shearwater Burrow Density. 5. Telemetry (GPS & Satellite).	1. Species, total numbers, Distribution, presence/absence of eggs or chicks in burrows. 2. Desktop literature review
		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	1. Johnstone et al. 2013. DATAHOLDER: WA MUSEUM. AMOSC/DBCA (DPaW) 2014. 2. BirdLife Australia DATAHOLDER: Woodside and BirdlLife Australia 3. Surman & Nicholson 2015. 4. BirdLife Australia: DATAHOLDER: Woodside 5. Cannel et al. 2019 DATAHOLDER: UWA and BirdLife Australia	1. AMOSC/DBCA 2014. DATAHOLDER: AMOSC/DBCA. 2. Report to Woodside commissioned study – Advisian (2021)
Turtles	**SM06**	**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	Ningaloo and the Muiron Islands	Dampier Archipelago
	Beach surveys (recording species, nests, and false crawls).	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.	1. Exmouth Islands Turtle Monitoring Program. 2. Ningaloo Turtle Program 3. Turtle activity and nesting on the Muiron Islands and Ningaloo Coast (2018). 4. Spatial and temporal use of inter-nesting habitat by sea turtles along the Muiron Islands and Ningaloo Coast – 2018-2019	1. DBCA Photogrammetry survey of marine turtle nesting beaches in Dampier Archipelago 2019-2020 2.Holden Beach sea turtle habitat. Pendoley Environmental (2006) on behalf of Woodside for the Pluto Development. 3. Marine turtle monitoring as part of DPAWs long-term turtle monitoring program within the Dampier Archipelago (ongoing) 4. Nesting ecology of flatback sea turtles *Natator depressus* from Delambre Island collected over 2–3 weeks each nesting season across six nesting seasons (2010-2016).
		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	1. Astron (on behalf of Santos) to address a gap in the knowledge of turtle numbers at key locations (offshore islands within the region) that are not currently part of an existing monitoring programs (e.g. the NTP). Field surveys were conducted in October 2013 and January 2014. Surveys were conducted on 12 islands, with each island surveyed once (with the exception of Beach 8 at North Muiron Island) and all tracks counted. 2. Long term trends in marine turtle populations, beach surveys, track counts, best location, mortality counts. 3. On-beach monitoring and aerial surveys. 4. Tagging (satellite transmitter), analysis of internesting, migration and foraging grounds movements and behaviour.	1. High Resolution aerial surveys 2. Adult tracks, body pits, nests, emerged nests. 3. Adult tracks, body pits, nests, emerged nests. 4. Flipper tag resightings and track counts
		References/Data:							

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	Ningaloo and the Muiron Islands	Dampier Archipelago
		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	1.Santos – Report. 2. NTP Annual Reports DATAHOLDERS: DBCA. Reports available at http://www.ningalooturtles.org.au/media_reports.html 3.Rob et al. 2019 DATAHOLDER: DBCA 4.Tucker et al. 2019 DATAHOLDER: DBCA	1. DBCA Karratha office 2. Pendoley Environmental 2006. DATAHOLDER: Woodside. 3. DBCA 4. Thums et al 2019 DATAHOLDER: AIMS
Fish	**SM09**	**Studies:**							
	Baited Remote Underwater Video Stations (BRUVS), Visual Underwater Counts (VUC), Diver Operated Video (DOV).	1. Glomar Shoal 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 Shoal and Rankin Bank surveys, 2017. GWF-2 Monitoring Programme. Quantitatively surveyed benthic habitats and communities. 4. Temporal Studies survey of Rankin Bank and Glomar Shoal, 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.	1. AIMS/DBCA 2014 Baseline Ningaloo Survey – repeat and expansion on the LTM (Co-funded survey: Woodside and AIMS). 2. Demersal fish populations – baseline assessment (AIMS/WAMSI). 3. DBCA study measured Species Richness, Community Composition, and Target Biomass, through UVC. BRUVS studies determining max N, Species Richness, and Biomass. 4. Pilbara Marine Conservation Partnership Stereo BRUVS in shallow water (~10m) in 2014 in northern region of the Ningaloo Marine Park, in shallow water (~10m) inside the lagoonal reef of the Ningaloo Marine Park in 2016, in deep water (~40m) across the length of the Ningaloo Marine Park in 2015, in shallow water outside of Ningaloo Reef from Waroora to Jurabi in 2015 and offshore of the Muiron Islands in 2015. 5. Elasmobranch faunal composition of Ningaloo Marine Park. 6. Juvenile fish recruitment surveys at Ningaloo reef. 7. Demersal fish assemblage sampling method comparison 8. Ningaloo Outlook (CSIRO) - Shallow and Deep Reefs Program	1. Fish assemblages quantitatively described Mermaid Sound using BRUVs. Recorded main habitat types (sand, reef, coral and macroalgae) and at a total of 412 sites. 2. West Australian Museum of Fish of Dampier archipelago. 3. Pilbara Marine Conservation Partnership Stereo BRUVS drops in shallow water (~10m) in 2015 around the Dampier Archipelago. 4. Finfish community monitoring as part of DBCA Dampier Archipelago Marine Monitoring Program (2007-ongoing).
		Methods:							

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	Ningaloo and the Muiron Islands	Dampier Archipelago
		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..	1. UVC surveys. 2. BRUVS Study with 304 video samples at three specific depth ranges (1-10 m, 10-30 m and 30-110m). 3. UVC surveys. 4. Stereo BRUVS 5. Snorkel and Scuba surveys. 5. Underwater visual census. 6. Diver operated video. 7. Diver UVC. 8. Diver UVC, stereo BRUVs	1. BRUVs, Stereo Baited Remote Underwater Video Systems. 2. Fish collected and species lists. 3. Stereo BRUVS. 4. Diver UVS.
		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.	1. AIMS 2014. DATAHOLDER: AIMS/Woodside. 2. Fitzpatrick et al. 2012. DATAHOLDERS: WAMSI, AIMS. 3. DBCA unpublished data. DATAHOLDER: DBCA/AIMS. 4. CSIRO Data DATAHOLDER: CSIRO Data Centre ([redacted]). 5. Stevens, J.D., P.R., White, W.T., McAuley, R.B., Meekan, M.G. 2009. 6. WAMSI unpublished data DATAHOLDER: AIMS ([redacted]). 7. DATAHOLDER: WAMSI 8. CSIRO – Ningaloo Outlook 2020.	1. SKM 2008. DATAHOLDER: Woodside. 2. Hutchins 2004. DATAHOLDER: Woodside and WAM. 3. CSIRO. DATAHOLDER: CSIRO [redacted]. 4. DBCA.

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ANNEX E: TACTICAL RESPONSE PLANS

TACTICAL RESPONSE PLANS
Exmouth
Mangrove Bay
Turquoise Bay
Yardie Creek
Muiron Islands
Jurabi to Lighthouse Beaches Exmouth
Ningaloo Reef - Refer to Mangrove/Turquoise bay and Yardie Creek
Exmouth Gulf
Shark Bay Area 1: Carnarvon to Wooramel
Shark Bay Area 2: Wooramel to Petite Point
Shark Bay Area 3: Petite Point to Dubaut Point
Shark Bay Area 4: Dubaut Point to Herald Bight
Shark Bay Area 5: Herald Bight to Eagle Bluff
Shark Bay Area 6: Eagle Bluff to Useless Loop
Shark Bay Area 7: Useless Loop to Cape Bellefin
Shark Bay Area 8: Cape Bellefin to Steep Point
Shark Bay Area 9: Western Shores of Edel Land
Shark Bay Area 10: Dirk Hartog Island
Shark Bay Area 11: Bernier and Dorre Islands
Abrohlos Islands: Pelseart Group
Abrohlos Islands: Wallabi Group
Abrohlos Islands: Easter Group
Dampier
Rankin Bank & Glomar Shoals
Barrow and Lowendal Islands
Pilbara Islands - Southern Island Group
Montebello Island - Stephenson Channel Nth
Montebello Island Champagne Bay & Chippendale channel
Montebello Island - Claret Bay
Montebello Island - Hermite/Delta Is Channel
Montebello Island - Hock Bay
Montebello Island - North & Kelvin Channel
Montebello Island - Sherry Lagoon Entrance
Withnell Bay
Holden Bay
King Bay
No Name Bay / No Name Beach
Enderby Island - Dampier
Rosemary Island - Dampier
Legendre Island - Dampier

Karratha Gas Plant
KGP to Whitnell Creek
KGP to Northern Shore
KGP Fire Pond & Estuary
KGP to No Name Creek
Broome
Sahul Shelf Submerged Banks and Shoals
Clerke Reef (Rowley Shoals)
Imperieuse Island (Rowley Shoals)
Mermaid Reef (Rowley Shoals)
Scott Reef
Oiled Wildlife Response
Exmouth
Dampier region
Shark Bay

APPENDIX E. NOPSEMA REPORTING FORMS

NOPSEMA Recordable Environmental Incident monthly Reporting Form
https://www.nopsema.gov.au/assets/Forms/A198750.doc

Report of an accident, dangerous occurrence or environmental incident
https://www.nopsema.gov.au/assets/Forms/N-03000-FM0831-Report-of-an-Accident-Dangerous-Occurrence-or-Environmental-Incident-Rev-8-Jan-2015-MS-Word-2010.docx

APPENDIX F. STAKEHOLDER CONSULTATION

Scarborough Seabed Intervention and Trunkline Installation Environment Plan

Date: December 2021

Revision: 0

TABLE OF CONTENTS

1. Consultation

1.1 Email sent to the following relevant stakeholders (31 August 2021)

- *ABF*
- *DISER*
- *DBCA*
- *DMIRS*
- *DoT*
- *APPEA*
- *Marine Tourism WA*
- *Recfishwest*

Dear stakeholder

Woodside is planning to submit an Environment Plan (EP) to undertake seabed intervention and Trunkline installation activities in Commonwealth waters for the Scarborough development, in accordance with the Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2009 (Cth).

A Consultation Information Sheet is attached, which provides background on the proposed activity, including a summary of potential key risk and associated management measures. It is also available on our website.

This EP falls under the primary environmental approval of the Scarborough Offshore Project Proposal (OPP) and will be conducted in line with relevant requirements of the OPP. The OPP includes a detailed description of activities and an assessment of impacts; with controls to develop acceptability criteria. It was accepted by NOPSEMA in March 2020 after an extensive public consultation process. Woodside is proposing four Commonwealth EPs for the Scarborough development to be submitted to NOPSEMA in the next two years, and will consult with all relevant stakeholders ahead of each EP.

A separate EP is planned to address Trunkline installation and seabed intervention activities in State waters, for approval by the Western Australian Department of Mines, Industry Regulation and Safety. The location of the proposed Trunkline in State waters is shown on the Consultation Information Sheet.

More information on the Scarborough development can be found here.

Activity:

Summary:	Seabed intervention and Trunkline installation activities in Commonwealth waters for the Scarborough development.
Location:	Activities run from the Commonwealth – State waters boundary approximately 32 km north of Dampier to the Scarborough gas field located at Woodside-operated title block WA-61-L, approximately 375 km west-northwest of the Burrup Peninsula.
Approx. Water Depth (m):	~ 32 m – 1400 m

Earliest commencement date:	Seabed intervention activities: Q4 2022 pending approvals, vessel availability and weather constraints Trunkline installation activities: Q4 2023 pending successful completion of State waters installation scope, approvals, vessel availability and weather constraints.
Estimated duration:	Approximately 24 months across multiple campaigns
Distance from Operational Area to nearest port/marina	Eastern end of the Trunkline route overlaps with the Pilbara Port Authority Dampier Port Limits
Distance from Operational Area to nearest marine park	• The trunkline corridor runs through the Montebello Marine Park – Multiple Use Zone (Cth), close to the northern boundary. • Offshore borrow ground located to the north of the Dampier Marine Park Habitat Protection Zone. A minimum 250 m buffer will be in place from the Marine Park boundaries.
Operational Areas	• **Scarborough Trunkline Project Area**: The proposed Trunkline from the Scarborough FPU (approximately 430 km north-west of the Burrup) to the State waters boundary and 1.5 km either side of the proposed Trunkline centreline to allow for the movement and positioning of vessels. This also includes Spoil Ground 5A, which is approximately 300 m wide and runs ~17 km from the State waters boundary. • **Offshore Borrow Ground Project Area**: Offshore Borrow Ground (location where sand will be sourced). The Offshore Borrow Ground is approximately 17 km^2, located 20 km to the east of the proposed Trunkline route and adjacent to the Dampier Marine Park.
Vessels:	• Trailing suction hopper dredge (TSHD) • Offshore construction vessel (OCV) • Fall pipe vessel (rock dump) • Primary Installation Vessel (PIV) multi-joint operation • Shallow Water Lay Barge (SWLB) • Anchor handling vessel/tug • Pipe supply vessels • Survey vessels • Support vessels • Fuel bunkering vessels

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 1800 442 977.

Your feedback and our response will be included in our Environment Plan 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 30 September 2021.

Regards

Graduate Corporate Affairs Adviser | Operations

1.2 Woodside Consultation Information Sheet (sent to all relevant stakeholders)

Woodside

STAKEHOLDER CONSULTATION

INFORMATION SHEET

August 2021

SCARBOROUGH SEABED INTERVENTION AND TRUNKLINE INSTALLATION

CARNARVON BASIN, NORTH-WEST AUSTRALIA

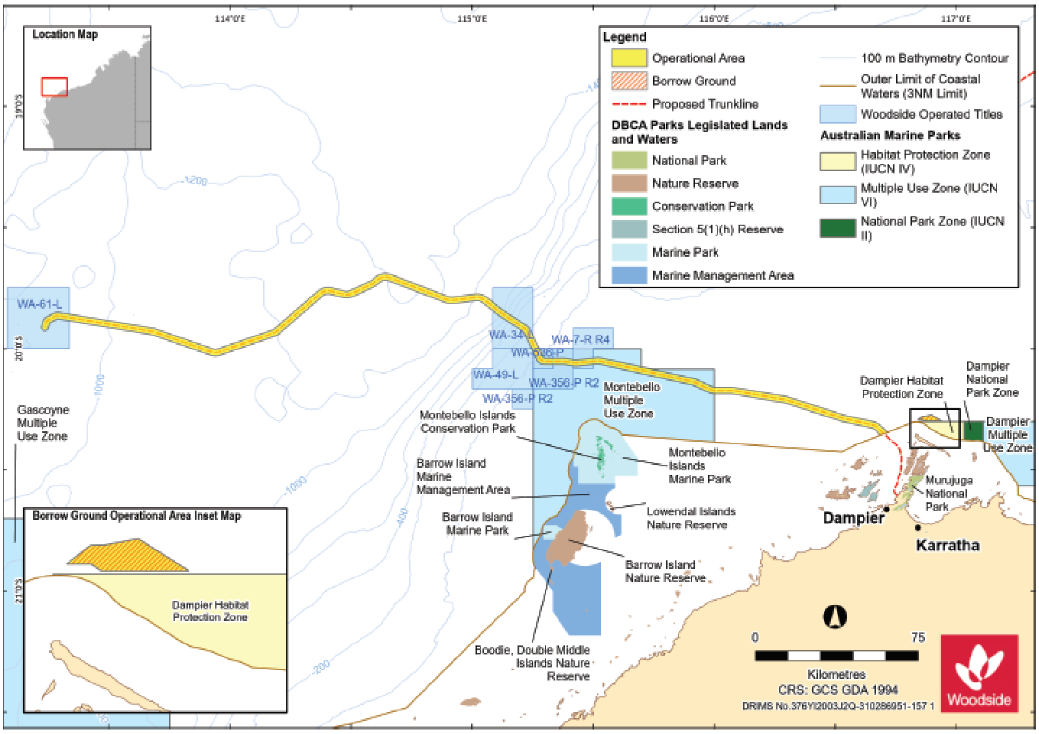
Woodside is planning to submit an Environment Plan (EP) to undertake seabed intervention and Trunkline installation activities in Commonwealth waters for the proposed Scarborough development, in accordance with the Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2009 (Cth).

The activity involves installation of a carbon steel pipeline (Trunkline) that runs approximately 430 km from the proposed offshore Scarborough Floating Production Unit (FPU) to the existing onshore Pluto LNG facility. The scope of this EP covers seabed intervention and installation activities for the section of the Trunkline in Commonwealth waters from the State waters boundary to the Pipeline End Termination (PLET) in WA-61-L. A separate EP is planned to address seabed intervention and Trunkline installation activities in State waters, for approval by the Western Australian Department of Mines, Industry Regulation and Safety.

Subject to relevant approvals and other constraints such as vessel availability and weather, seabed intervention activities are expected to start in late 2022. Trunkline installation activities in Commonwealth waters are expected to commence in late 2023 following successful completion of the State waters installation scope. The Petroleum Activities Program is expected to take around 24 months to execute with activities occurring in multiple campaigns.

Woodside is operator of the Scarborough field (WA-61-L) with a 73.5% interest. BHP Petroleum (North West Shelf) Pty Ltd holds the remaining 26.5% share in the title.

Figure 1. Proposed Scarborough Seabed Intervention and Trunkline Installation Operational Area



Proposed Activity

Table 1 – Activity summary and project vessels

Item	Description
Location	• Carnarvon Basin, North-West Australia
Water depth	• Approximately 32 m (Trunkline route at State waters boundary) to 1400 m (deepest point approximately 275 km along the Trunkline route)
Earliest commencement date	• Seabed intervention activities: Q4 2022 pending approvals, vessel availability and weather constraints • Trunkline installation activities: Q4 2023 pending successful completion of State waters installation scope, approvals, vessel availability and weather constraints.
Estimated duration	• Approximately 24 months across multiple campaigns
Distance from Operational Area to nearest port/marina	• Eastern end of the Trunkline route overlaps with the Pilbara Port Authority Dampier Port Limits
Distance from Operational Area to nearest marine park	• The trunkline corridor runs through the Montebello Marine Park – Multiple Use Zone (Cwlth), close to the northern boundary • Offshore borrow ground located to the north of the Dampier Marine Park Habitat Protection Zone
Seabed Intervention	
Key Vessels	• Trailing suction hopper dredge (TSHD) • Offshore construction vessel (OCV) • Fall pipe vessel (rock dump) • Survey vessels • Support vessels • Fuel bunkering vessels
Key Activities	• Surveys: » Geophysical (including hydrographic surveys) » Geotechnical » Prelay survey before pipelay (visual and multibeam echo sounder) • Trenching along the Trunkline route and material disposal at existing Spoil Ground 5A • Borrow ground dredging and backfill along the trunkline • Continental slope crossing seabed preparation • Trunkline and infrastructure crossing supports installation, using rock and mattresses • Trunkline pre and post lay span rectification • Contingent seabed intervention activities including maintenance, dredging/excavation of resettled material in the trench prior to pipelay, post lay dredging, grout bags and rock dumping
Trunkline Installation	
Key Vessels	• Primary Installation Vessel (PIV) multi-joint operation • Shallow Water Lay Barge (SWLB) • Anchor handling vessel/tug • Pipe supply vessels • Offshore construction vessel (OCV) • Survey vessels • Fuel bunkering vessels
Key activities	• Surveys: » Pre-lay survey of the trunkline route prior to commencement of pipelay (visual and multibeam echo sounder) » Post-lay as-built survey of the completed trunkline (visual and multibeam echo sounder) • Installation of the Trunkline by a SWLB in the shallow water section of the route where the DP pipelay vessel may not be able to access due to water depth restrictions • Setting of SWLB anchors with anchor handling vessel/tug • Installation of the Trunkline by the PIV • Installation of PLET and ancillary structures as required through design by the PIV • Continuous delivery of pipe to the SWLB and PIV by pipe supply vessels • Installation of the foundations for the PLET structure by a construction vessel prior to the installation of the PLET • Dry pre-commissioning of the trunkline by a construction vessel • Contingent activities including wet commissioning, wet buckle recovery and Flood, Clean, Gauge, Testing

Proposed Locations

The Operational Area includes the following Project Areas:

- **Scarborough Trunkline Project Area:** The proposed Trunkline from the Scarborough FPU (approximately 430 km north-west of the Burrup) to the State waters boundary and 1.5 km either side of the proposed Trunkline centreline to allow for the movement and positioning of vessels (includes Spoil Ground 5A which is included in the Trunkline operational area.).
- **Offshore Borrow Ground Project Area:** Offshore Borrow Ground (location where sand will be sourced to assist with Trunkline stabilisation).

Within Commonwealth waters, the Scarborough Trunkline will extend from the FPU towards the existing Pluto offshore platform and infrastructure, approximately 200 km offshore north-west of the Burrup. The Scarborough Trunkline will then deviate to the south to avoid the existing facilities and minimise environmental, technical and safety risks. From approximately 20 km south-east of the Pluto platform, the Trunkline will be routed alongside the Pluto Trunkline until it reaches Mermaid Sound.

Sand may be required to assist with stabilisation along a ~20 km section of the Scarborough Trunkline from the State waters boundary. This sand is proposed to be obtained from the Offshore Borrow Ground Project Area in Commonwealth waters, as shown in Figure 1. The Offshore Borrow Ground is approximately 17 km2, located 20 km to the east of the proposed Trunkline route and adjacent to the Dampier Marine Park. A minimum 250 m buffer will be in place from the Marine Park boundaries.

Communications with Mariners

Safety exclusion zones will apply around the seabed intervention and the Trunkline installation vessels. 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 informed other stakeholders who have an identified interest in the 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 construction and installation activities. This EP approval falls under the primary environmental approval of the Scarborough Offshore Project Proposal (OPP) and the activities will be conducted in line with relevant requirements of the OPP. A number of mitigation and management measures will be implemented and are summarised in Table 2. These measures will continue to be developed in conjunction with the EP, including impact assessments and controls to reduce impacts to an ALARP and acceptable level. Further details will be provided in the EP.

About Scarborough

The Scarborough gas resource is located offshore, approximately 375 km west-northwest of the Burrup Peninsula and is part of the Greater Scarborough gas fields which are estimated to hold 13.0 Tcf (2C, 100%) of dry gas.

Woodside, as operator of the Scarborough Joint Venture, is proposing to develop the Scarborough gas resource through new offshore facilities connected by an approximately 430 km pipeline to a proposed expansion of the existing Pluto LNG onshore facility (Pluto Train 2).

For more information about the proposed Scarborough development, visit woodside.com.au.

Table 2 – Summary of key risks and/or impacts and management measures.

Potential Risk and/or Impact	Mitigation and/or Management Measure
Planned activities	
Interests of relevant stakeholders with respect to: • Defence activities • Petroleum activities • Commercial 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 EP. • Advice to relevant stakeholders prior to the commencement of activities. • All vessels within the Scarborough activity area will adhere to the navigation safety requirements including the Navigation Act 2012 and any subsequent Marine Orders.
Marine fauna interactions	• Vessel masters will implement interaction management actions in accordance with the EPBC Regulations 2000. • The dredging vessel will have trained crew as marine fauna observers and adhere to the observation and exclusion zones for marine fauna.
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	• Infrastructure will be positioned on the seabed within design footprint to reduce seabed disturbance. • Bathymetric and other surveys will be undertaken to monitor seabed characteristics before and after activities. • A management framework for dredging and backfill activities based on water quality will be developed. • Dredging and spoil disposal activities will be undertaken in compliance with a sea dumping permit. • A minimum 250 m buffer from the Dampier Marine Park boundaries will be in place for the borrow ground dredging activities.
Vessel interaction	• Woodside will notify relevant fishery stakeholders and government maritime safety agencies of specific start and end dates, specific vessel-on-location dates and any exclusion zones prior to commencement of the activity.

Potential Risk and/or Impact	Mitigation and/or Management Measure
Waste management	• 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 accidental loss to the environment. • Wastes transported onshore will be sent to appropriate recycling or disposal facilities by a licensed waste contractor.
Unplanned activities	
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. • Contracted vessels comply with Australian ballast water requirements.

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 30 September 2021.

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 for this information to remain confidential to NOPSEMA.

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 Director of National Parks (31 August 2021)

Dear Director of National Parks,

Woodside is planning to submit an Environment Plan (EP) to undertake seabed intervention and trunkline installation activities in Commonwealth waters for the Scarborough development, in accordance with the Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2009 (Cth).

This EP falls under the primary environmental approval of the Scarborough Offshore Project Proposal (OPP) and will be conducted in line with relevant requirements of the OPP. The OPP includes a detailed description of activities and an assessment of impacts; with controls to develop acceptability criteria. It was accepted by NOPSEMA in March 2020 after an extensive public consultation process. Woodside is proposing four Commonwealth EPs for the Scarborough development to be submitted to NOPSEMA in the next two years, and will consult with all relevant stakeholders ahead of each EP.

Table 1 – Key project risks relevant to Commonwealth Marine Parks

Activity	Impact / Risk	Marine Park	Controls*
Planned:			
Borrow Ground Dredging	Turbidity, Seabed disturbance	Adjacent to Dampier Marine Park	• A 250 m buffer zone will be implemented between the offshore borrow ground and the Dampier AMP • Compliance with sea dumping permit SD2019-3982 • Tiered monitoring and management framework for dredging and backfill activities based on water quality. *Note telemetered water quality monitoring site on marine park boundary. • EPBC Regulations 2000 Part 8 Division 8.1 Interacting with Cetaceans • During daylight hours, trained vessel crew onboard the dredge will visually assess marine fauna and observation and exclusion zones will be adhered to for dredging and backfill operations • Turtle deflection chains installed on the TSHD drag head.
Trunkline installation & infrastructure crossings	Seabed disturbance / footprint	Montebello Marine Park	• Infrastructure will be positioned on the seabed within design footprint to reduce seabed disturbance.
Vessel presence	Lighting & underwater noise	Montebello & Dampier Marine Parks	• Lighting will be limited the minimum required for navigational and safety requirements, except for emergency events. • EPBC Regulations 2000 Part 8 Division 8.1 Interacting with cetaceans.
Unplanned:			
Vessel presence	Invasive Marine Species (IMS)	Montebello & Dampier Marine Parks	• Compliance with the Woodside Invasive Marine Species Management Plan. • Requirements of the Australian Ballast Water Management guidelines to be met.

Vessel collision	Hydrocarbon release	All parks within EMBA	• All vessels and facilities (appropriate to class) will comply with MARPOL 73/78, the Navigation Act 2012, the Protection of the Sea (Prevention of Pollution from Ships Act 1983 and subsequent Marine Orders • Relevant Stakeholders will be notified of activities prior to commencement • Vessels will have in place a valid and appropriate Shipboard Oil Pollution Emergency Plan and/or Shipboard Marine Pollution Emergency Plan. Emergency response activities will be implemented in accordance with the SOPEP/SMPEP • Environment Plans and Oil Pollution Emergency Plans will be accepted and in place, appropriate to the credible hydrocarbon spill scenario associated with activities during the development of Scarborough. • Emergency response activities will be implemented in accordance with the OPEP • Emergency response capability will be maintained in accordance with EP, OPEP and related documentation.

*Further controls commensurate with residual risk level to be proposed during EP development.

A separate EP is planned to address Trunkline installation and seabed intervention activities in State waters, for approval by the Western Australian Department of Mines, Industry Regulation and Safety. The location of the proposed Trunkline in State waters is shown on the Consultation Information Sheet.

Implications for Parks Australia interests

Parks Australia (Director of National Parks) were identified as a key stakeholder for consultation during initial development of the Seabed Intervention EP in 2020. Parks Australia were previously engaged by Woodside and presented with information on activities that may impact marine parks, particularly the Montebello and Dampier Marine Parks, as well as studies carried out by Woodside to inform impact assessments and the OPP. In mid-2020 when the Scarborough project was put on hold for a period, development of the EP and subsequent consultation also paused.

With recommencement of the Seabed Intervention and Trunkline Installation EP development recently, some changes to highlight include:

- EP scope now includes Trunkline installation, as well as seabed intervention.
- Woodside will adopt the NOPSEMA Oil Spill Modelling Bulletin exposure values for dissolved and entrained hydrocarbons when analysing oil spill modelling outcomes. This means the previous Environment that May be Affected (EMBA) presented in the OPP will change slightly.
- Revised modelling has been carried out for borrow ground dredging activities due to progression in project definition and input data. This modelling aids in the assessment of suspended sediment impact potential on benthic and other communities, and will be presented in detail in the EP.

These changes, along with the environmental risk factors described in **Table 1** below, will be discussed in more depth during a virtual consultation meeting with Parks Australia representatives - currently scheduled for 13 September 2021.

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.

More information on the Scarborough development can be found here.

Feedback:
In line with Australian Government guidance on consultation with government agencies, can you please advise within 10 business days if you have any feedback on the proposed activity, noting that your feedback and our response will be included in an Environment Plan for consideration by the National Offshore Petroleum Safety and Environmental Management Authority, as is required under the Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2009 (Cth).

We would also be happy to meet online should you wish to discuss the proposed activity in more detail.

Regards

Graduate Corporate Affairs Adviser | Operations

1.4 Email sent to AMSA and AHO (31 August 2021)

Dear AMSA / AHO

Woodside is planning to submit an Environment Plan (EP) to undertake seabed intervention and trunkline installation activities in Commonwealth waters for the Scarborough development, in accordance with the Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2009 (Cth).

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 channel map is also attached.

This EP falls under the primary environmental approval of the Scarborough Offshore Project Proposal (OPP) and will be conducted in line with relevant requirements of the OPP. The OPP includes a detailed description of activities and an assessment of impacts; with controls to develop acceptability criteria. It was accepted by NOPSEMA in March 2020 after an extensive public consultation process. Woodside is proposing four Commonwealth EPs for the Scarborough development to be submitted to NOPSEMA in the next two years, and will consult with all relevant stakeholders ahead of each EP.

A separate EP is planned to address Trunkline installation and seabed intervention activities in State waters, for approval by the Western Australian Department of Mines, Industry Regulation and Safety. The location of the proposed Trunkline in State waters is shown on the Consultation Information Sheet.

More information on the Scarborough development can be found here.

Activity:

Summary:	Seabed intervention and Trunkline installation activities in Commonwealth waters for the Scarborough development.
Location:	Activities run from the Commonwealth – State waters boundary approximately 32 km north of Dampier to the Scarborough gas field located at Woodside-operated title block WA-61-L, approximately 375 km west-northwest of the Burrup Peninsula.
Approx. Water Depth (m):	~ 32 m – 1400 m

Earliest commencement date:	Seabed intervention activities: Q4 2022 pending approvals, vessel availability and weather constraints Trunkline installation activities: Q4 2023 pending successful completion of State waters installation scope, approvals, vessel availability and weather constraints.
Estimated duration:	Approximately 24 months across multiple campaigns
Distance from Operational Area to nearest port/marina	Eastern end of the Trunkline route overlaps with the Pilbara Port Authority Dampier Port Limits
Distance from Operational Area to nearest marine park	• The trunkline corridor runs through the Montebello Marine Park – Multiple Use Zone (Cth), close to the northern boundary. • Offshore borrow ground located to the north of the Dampier Marine Park Habitat Protection Zone. A minimum 250 m buffer will be in place from the Marine Park boundaries.
Operational Areas	• **Scarborough Trunkline Project Area**: The proposed Trunkline from the Scarborough FPU (approximately 430 km north-west of the Burrup) to the State waters boundary and 1.5 km either side of the proposed Trunkline centreline to allow for the movement and positioning of vessels. This also includes Spoil Ground 5A, which is approximately 300 m wide and runs ~17 km from the State waters boundary. • **Offshore Borrow Ground Project Area**: Offshore Borrow Ground (location where sand will be sourced). The Offshore Borrow Ground is approximately 17 km^2, located 20 km to the east of the proposed Trunkline route and adjacent to the Dampier Marine Park.
Vessels:	• Trailing suction hopper dredge (TSHD) • Offshore construction vessel (OCV) • Fall pipe vessel (rock dump) • Primary Installation Vessel (PIV) multi-joint operation • Shallow Water Lay Barge (SWLB) • Anchor handling vessel/tug • Pipe supply vessels • Survey vessels • Support vessels • Fuel bunkering vessels

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 1800 442 977.

Your feedback and our response will be included in our Environment Plan 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).

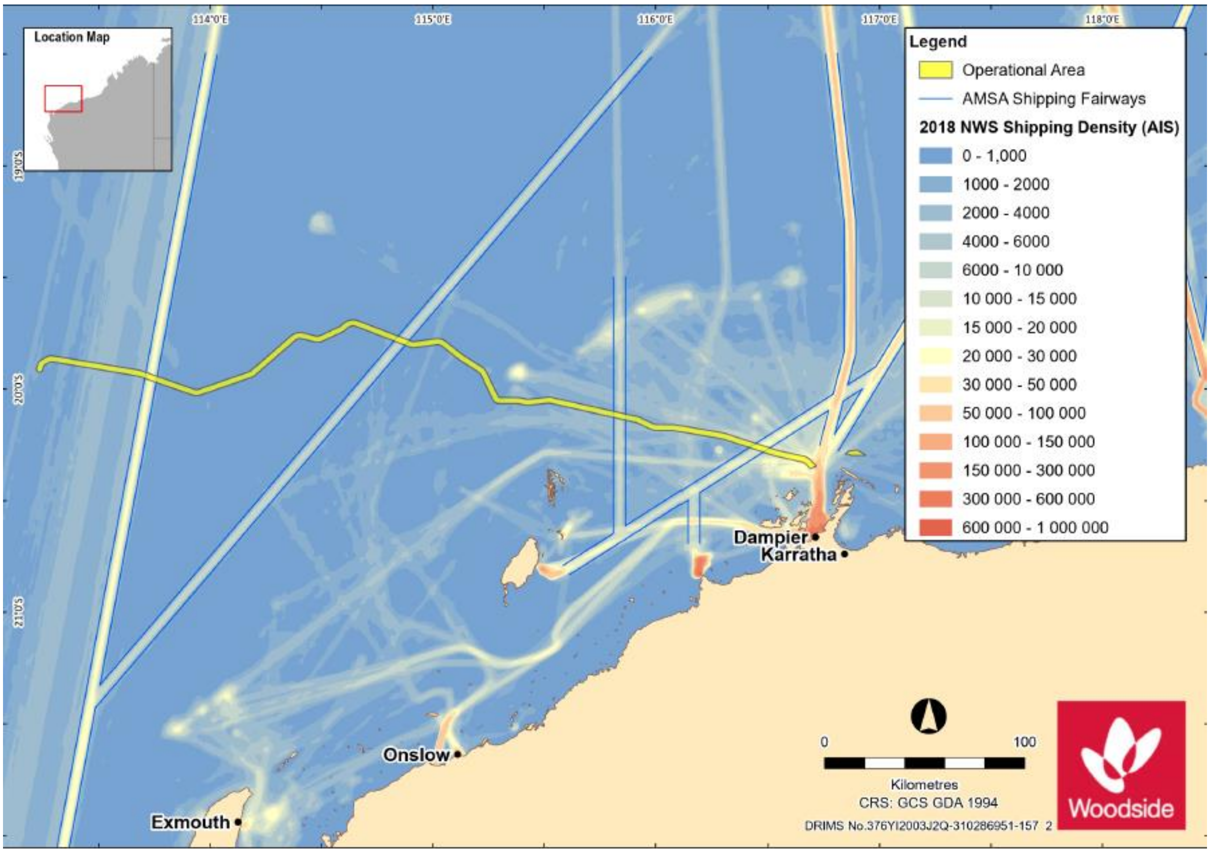
Please let us know if your feedback for this activity is sensitive and we will make this known to NOPSEMA upon submission of the Environment Plan in order for this information to remain confidential to NOPSEMA.

Please provide your views by 30 September 2021.

Regards

Graduate Corporate Affairs Adviser | Operations

1.5 Shipping lanes map sent to AMSA and AHO (31 August 2021)



1.6 Email sent to DAWE (31 August 2021)

Dear DAWE

Woodside is planning to submit an Environment Plan (EP) to undertake seabed intervention and trunkline installation activities in Commonwealth waters for the Scarborough development, in accordance with the Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2009 (Cth).

A Consultation Information Sheet is attached, which provides background on the proposed activity, including a summary of potential key risk and associated management measures. The Information Sheet is also available on our website. A map of relevant fisheries is also attached.

This EP falls under the primary environmental approval of the Scarborough Offshore Project Proposal (OPP) and will be conducted in line with relevant requirements of the OPP. The OPP includes a detailed description of activities and an assessment of impacts; with controls to develop acceptability criteria. It was accepted by NOPSEMA in March 2020 after an extensive public consultation process. Woodside is proposing four Commonwealth EPs for the Scarborough development to be submitted to NOPSEMA in the next two years, and will consult with all relevant stakeholders ahead of each EP.

A separate EP is planned to address Trunkline installation and seabed intervention activities in State waters, for approval by the Western Australian Department of Mines, Industry Regulation and Safety. The location of the proposed Trunkline in State waters is shown on the Consultation Information Sheet.

More information on the Scarborough development can be found here.

Implications for DAWE's interests:
We have identified and assessed potential risks and impacts to active Commonwealth commercial fishers, biosecurity matters and the marine environment that overlap the proposed Operational Area in the development of the proposed Environment Plan for this activity.

Woodside has endeavoured to reduce these risks to an as low as reasonably practicable (ALARP) level.

Commercial fishing implications:
Based on recent advice from the Australian Fishing Management Authority, Woodside will consult with licence holders in the following fisheries (on the basis of fishing licence overlap with the Operational Area) and will provide a fact sheet containing information relevant to commercial fishing interests:

- North-West Slope Trawl Fishery
- Western Deepwater Trawl Fishery
- Western Skipjack Fishery
- Southern Bluefin Tuna Fishery
- Western Tuna and Billfish Fishery

Biosecurity implications:
With respect to the biosecurity matters, please note the following information below.

Potential IMS risk	***IMS mitigation management***
Introduction and establishment of IMS.	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 1800 442 977.

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 30 September 2021.

Regards

Graduate Corporate Affairs Adviser | Operations

1.7 Email sent to Department of Defence (31 August 2021)

Dear Department of Defence,

Woodside is planning to submit an Environment Plan (EP) to undertake seabed intervention and trunkline installation activities in Commonwealth waters for the Scarborough development, in accordance with the Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2009 (Cth).

A Consultation Information Sheet is attached, which provides background on the proposed activity, including a summary of potential key risk and associated management measures. The Information Sheet is also available on our website. A map of practice and training defence areas is also attached.

This EP falls under the primary environmental approval of the Scarborough Offshore Project Proposal (OPP) and will be conducted in line with relevant requirements of the OPP. The OPP includes a detailed description of activities and an assessment of impacts; with controls to develop acceptability criteria. It was accepted by NOPSEMA in March 2020 after an extensive public consultation process. Woodside is proposing four Commonwealth EPs for the Scarborough development to be submitted to NOPSEMA in the next two years, and will consult with all relevant stakeholders ahead of each EP.

A separate EP is planned to address Trunkline installation and seabed intervention activities in State waters, for approval by the Western Australian Department of Mines, Industry Regulation and Safety. The location of the proposed Trunkline in State waters is shown on the Consultation Information Sheet.

More information on the Scarborough development can be found here.

Activity:

Summary:	Seabed intervention and Trunkline installation activities in Commonwealth waters for the Scarborough development.
Location:	Activities run from the Commonwealth – State waters boundary approximately 32 km north of Dampier to the Scarborough gas field located at Woodside-operated title block WA-61-L, approximately 375 km west-northwest of the Burrup Peninsula.
Approx. Water Depth (m):	~ 32 m – 1400 m
Earliest commencement date:	Seabed intervention activities: Q4 2022 pending approvals, vessel availability and weather constraints Trunkline installation activities: Q4 2023 pending successful completion of State waters installation scope, approvals, vessel availability and weather constraints.

Estimated duration:	Approximately 24 months across multiple campaigns
Distance from Operational Area to nearest port/marina	Eastern end of the Trunkline route overlaps with the Pilbara Port Authority Dampier Port Limits
Distance from Operational Area to nearest marine park	• The trunkline corridor runs through the Montebello Marine Park – Multiple Use Zone (Cth), close to the northern boundary. • Offshore borrow ground located to the north of the Dampier Marine Park Habitat Protection Zone. A minimum 250 m buffer will be in place from the Marine Park boundaries.
Operational Areas	• **Scarborough Trunkline Project Area**: The proposed Trunkline from the Scarborough FPU (approximately 430 km north-west of the Burrup) to the State waters boundary and 1.5 km either side of the proposed Trunkline centreline to allow for the movement and positioning of vessels. This also includes Spoil Ground 5A, which is approximately 300 m wide and runs ~17 km from the State waters boundary. • **Offshore Borrow Ground Project Area**: Offshore Borrow Ground (location where sand will be sourced). The Offshore Borrow Ground is approximately 17 km^2, located 20 km to the east of the proposed Trunkline route and adjacent to the Dampier Marine Park.
Vessels:	• Trailing suction hopper dredge (TSHD) • Offshore construction vessel (OCV) • Fall pipe vessel (rock dump) • Primary Installation Vessel (PIV) multi-joint operation • Shallow Water Lay Barge (SWLB) • Anchor handling vessel/tug • Pipe supply vessels • Survey vessels • Support vessels • Fuel bunkering vessels

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 1800 442 977.

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).

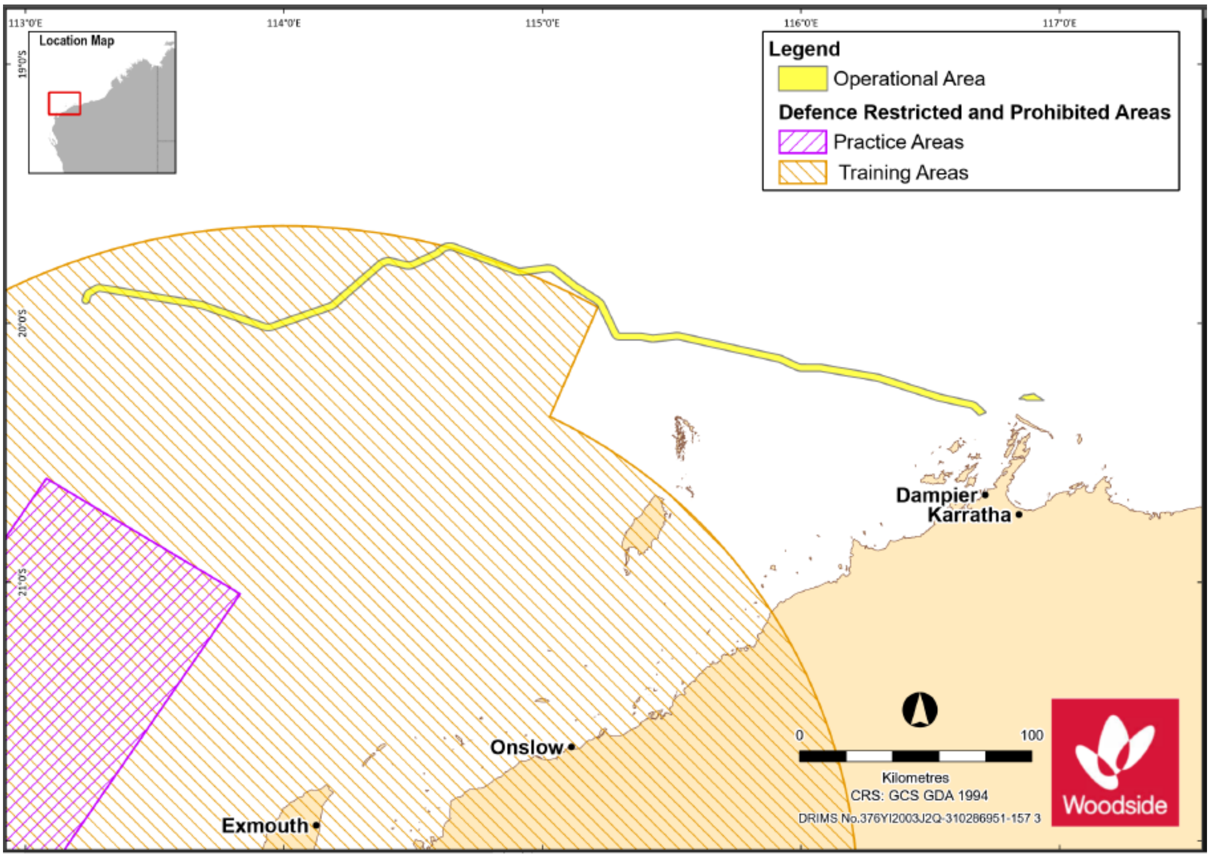
Please let us know if your feedback for this activity is sensitive and we will make this known to NOPSEMA upon submission of the Environment Plan in order for this information to remain confidential to NOPSEMA.

Please provide your views by 30 September 2021.

Regards

Graduate Corporate Affairs Adviser | Operations

1.8 Defence areas map sent to Department of Defence (31 August 2021)



1.9 Email sent to WAFIC (31 August 2021)

Dear [redacted]

Woodside is planning to submit an Environment Plan (EP) to undertake seabed intervention and trunkline installation activities in Commonwealth waters for the Scarborough development, in accordance with the Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2009 (Cth).

We have identified potential impacts to commercial fishers and the environment and are currently working to reduce these risks to as low as reasonably practicable as we develop the EP. Fisheries have been identified as being relevant based on fishing area overlap with the activity area, assessment of government fishing effort data from recent years, fishing methods and water depth. We also note AFMA's recent advice and will consult with all Commonwealth fishery licences that overlap the Operational Area.

An information sheet (also on our website) and map of relevant fisheries are attached.

This EP falls under the primary environmental approval of the Scarborough Offshore Project Proposal (OPP) and will be conducted in line with relevant requirements of the OPP. The OPP includes a detailed description of activities and an assessment of impacts; with controls to develop acceptability criteria. It was accepted by NOPSEMA in March 2020 after an extensive public consultation process. Woodside is proposing four Commonwealth EPs for the Scarborough development to be submitted to NOPSEMA in the next two years, and will consult with all relevant stakeholders ahead of each EP.

A separate EP is planned to address Trunkline installation and seabed intervention activities in State waters, for approval by the Western Australian Department of Mines, Industry Regulation and Safety. The location of the proposed Trunkline in State waters is shown on the Consultation Information Sheet.

More information on the Scarborough development can be found here.

Activity:

Summary:	Seabed intervention and Trunkline installation activities in Commonwealth waters for the Scarborough development.
Location:	Activities run from the Commonwealth – State waters boundary approximately 32 km north of Dampier to the Scarborough gas field located at Woodside-operated title block WA-61-L, approximately 375 km west-northwest of the Burrup Peninsula.
Approx. Water Depth (m):	~ 32 m – 1400 m
Earliest commencement date:	Seabed intervention activities: Q4 2022 pending approvals, vessel availability and weather constraints. Trunkline installation activities: Q4 2023 pending successful completion of State waters installation scope, approvals, vessel availability and weather constraints.
Estimated duration:	Approximately 24 months across multiple campaigns.
Distance from Operational Area to nearest port/marina	Eastern end of the Trunkline route overlaps with the Pilbara Port Authority Dampier Port Limits
Distance from Operational Area to nearest marine park	• The trunkline corridor runs through the Montebello Marine Park – Multiple Use Zone (Cth), close to the northern boundary. • Offshore borrow ground located to the north of the Dampier Marine Park Habitat Protection Zone. A minimum 250 m buffer will be in place from the Marine Park boundaries.
Operational Areas	• **Scarborough Trunkline Project Area**: The proposed Trunkline from the Scarborough FPU (approximately 430 km north-west of the Burrup) to the State waters boundary and 1.5 km either side of the proposed Trunkline centreline to allow for the movement and positioning of vessels. This also includes Spoil Ground 5A, which is approximately 300 m wide and runs ~17 km from the State waters boundary. • **Offshore Borrow Ground Project Area**: Offshore Borrow Ground (location where sand will be sourced). The Offshore Borrow Ground is approximately 17 km^2, located 20 km to the east of the proposed Trunkline route and adjacent to the Dampier Marine Park.
Relevant Fisheries	**Commonwealth:** North-West Slope Trawl Fishery **State:** Mackerel Managed Fishery (Area 2 and 3), Pilbara Crab Managed Fishery, Nickol Bay Prawn Managed Fishery, Pilbara Trawl Fishery, Pilbara Trap Fishery, Pilbara Line Fishery, Marine Aquarium Fishery and Specimen Shell Fishery **Note:** We note previous WAFIC advice that the Marine Aquarium Fishery and Specimen Shell Fishery are dive and wade fisheries at shallow water depth. We have taken a 'cautionary' approach given the water depth of the proposed activity (~ 32 m) and catch and effort data.

*Additional Fisheries (*Consultation based on AFMA advice to consult all fisheries with entitlements to fish in the area)*	**Commonwealth:** Western Deepwater Trawl Fishery, Western Skipjack Fishery, Southern Bluefin Tuna Fishery, Western Tuna and Billfish Fishery
Exclusionary/Cautionary Zone:	Temporary safety exclusion zones will be confirmed prior to the activity commencing and will be issued with notifications to mariners at the time of the activity. The temporary exclusion zones will likely range between 500 – 1500 m depending on the vessel type and activity being carried out.
Vessels:	• Trailing suction hopper dredge (TSHD) • Offshore construction vessel (OCV) • Fall pipe vessel (rock dump) • Primary Installation Vessel (PIV) multi-joint operation • Shallow Water Lay Barge (SWLB) • Anchor handling vessel/tug • Pipe supply vessels • Survey vessels • Support vessels • Fuel bunkering vessels

Potential risks to commercial fishing and proposed mitigation measures:

Potential Risk and/or Impact	Mitigation and/or Management Measure
Planned activities	
Interests of relevant stakeholders with respect to: • Defence activities • Petroleum activities • Commercial 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 EP. • Advice to relevant stakeholders prior to the commencement of activities. • All vessels within the Scarborough activity area will adhere to the navigation safety requirements including the Navigation Act 2012 and any subsequent Marine Orders.
Marine fauna interactions	• Vessel masters will implement interaction management actions in accordance with the EPBC Regulations 2000. • The dredging vessel will have trained crew as marine fauna observers and adhere to the observation and exclusion zones.
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	• Infrastructure will be positioned on the seabed within design footprint to reduce seabed disturbance. • Bathymetric and other surveys will be undertaken to monitor seabed characteristics before and after activities. • A management framework for dredging and backfill activities based on water quality will be developed.

	• Dredging and spoil disposal activities will be undertaken in compliance with a sea dumping permit. • A minimum 250 m buffer from the Dampier Marine Park boundaries will be in place for the borrow ground dredging activities.
Vessel interaction	• Woodside will notify relevant fishery stakeholders and government maritime safety agencies of specific start and end dates, specific vessel-on-location dates and any exclusion zones prior to commencement of the activity.
Waste management	• 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 accidental loss to the environment. • Wastes transported onshore will be sent to appropriate recycling or disposal facilities by a licensed waste contractor.
Unplanned activities	
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. • Contracted vessels comply with Australian ballast water requirements.

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 1800 442 977.

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 30 September 2021.

Regards

Graduate Corporate Affairs Adviser | Operations

1.10 Email sent to State fisheries licence holders (Pilbara Line, Pilbara Trap, Pilbara Trawl) (31 August 2021)

Dear Licence Holder

Woodside is planning to submit an Environment Plan (EP) to undertake seabed intervention and trunkline installation activities in Commonwealth waters for the Scarborough development, in accordance with the Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2009 (Cth).

This EP falls under the primary environmental approval of the Scarborough Offshore Project Proposal (OPP) and will be conducted in line with relevant requirements of the OPP. The OPP includes a detailed description of activities and an assessment of impacts; with controls to develop acceptability criteria. It was accepted by NOPSEMA in March 2020 after an extensive public consultation process. Woodside is proposing four Commonwealth EPs for the Scarborough development to be submitted to NOPSEMA in the next two years, and will consult with all relevant stakeholders ahead of each EP.

A separate EP is planned to address Trunkline installation and seabed intervention activities in State waters, for approval by the Western Australian Department of Mines, Industry Regulation and Safety. The location of the proposed Trunkline in State waters is shown on the Consultation Information Sheet.

Seabed intervention activities are planned to commence in 2022 and trunkline installation activities in 2023, pending approvals, vessel availability and weather constraints, in water depths ranging from approximately 32 m to 1400 m.

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 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.

More information on the Scarborough development can be found here.

Activity:

Summary:	Seabed intervention and Trunkline installation activities in Commonwealth waters for the Scarborough development.
Location:	Activities run from the Commonwealth – State waters boundary approximately 32 km north of Dampier to the Scarborough gas field located at Woodside-operated title block WA-61-L, approximately 375 km west-northwest of the Burrup Peninsula.
Approx. Water Depth (m):	~ 32 m – 1400 m
Earliest commencement date:	Seabed intervention activities: Q4 2022 pending approvals, vessel availability and weather constraints. Trunkline installation activities: Q4 2023 pending successful completion of State waters installation scope, approvals, vessel availability and weather constraints.
Estimated duration:	Approximately 24 months across multiple campaigns.
Distance from Operational Area to nearest port/marina	Eastern end of the Trunkline route overlaps with the Pilbara Port Authority Dampier Port Limits
Distance from Operational Area to nearest marine park	• The trunkline corridor runs through the Montebello Marine Park – Multiple Use Zone (Cth), close to the northern boundary.

	• Offshore borrow ground located to the north of the Dampier Marine Park Habitat Protection Zone. A minimum 250 m buffer will be in place from the Marine Park boundaries.
Operational Areas	• **Scarborough Trunkline Project Area**: The proposed Trunkline from the Scarborough FPU (approximately 430 km north-west of the Burrup) to the State waters boundary and 1.5 km either side of the proposed Trunkline centreline to allow for the movement and positioning of vessels. This also includes Spoil Ground 5A, which is approximately 300 m wide and runs ~17 km from the State waters boundary. • **Offshore Borrow Ground Project Area**: Offshore Borrow Ground (location where sand will be sourced). The Offshore Borrow Ground is approximately 17 km^2, located 20 km to the east of the proposed Trunkline route and adjacent to the Dampier Marine Park.
Relevant Fisheries	**Commonwealth:** North-West Slope Trawl Fishery **State:** Mackerel Managed Fishery (Area 2 and 3), Pilbara Crab Managed Fishery, Nickol Bay Prawn Managed Fishery, Pilbara Trawl Fishery, Pilbara Trap Fishery, Pilbara Line Fishery, Marine Aquarium Fishery and Specimen Shell Fishery **Note:** We note previous WAFIC advice that the Marine Aquarium Fishery and Specimen Shell Fishery are dive and wade fisheries at shallow water depth. We have taken a 'cautionary' approach given the water depth of the proposed activity (~ 32 m) and catch and effort data.
*Additional Fisheries (*Consultation based on AFMA advice to consult all fisheries with entitlements to fish in the area)*	**Commonwealth:** Western Deepwater Trawl Fishery, Western Skipjack Fishery, Southern Bluefin Tuna Fishery, Western Tuna and Billfish Fishery
Exclusionary/Cautionary Zone:	Temporary safety exclusion zones will be confirmed prior to the activity commencing and will be issued with notifications to mariners at the time of the activity. The temporary exclusion zones will likely range between 500 – 1500 m depending on the vessel type and activity being carried out.
Vessels:	• Trailing suction hopper dredge (TSHD) • Offshore construction vessel (OCV) • Fall pipe vessel (rock dump) • Primary Installation Vessel (PIV) multi-joint operation • Shallow Water Lay Barge (SWLB) • Anchor handling vessel/tug • Pipe supply vessels • Survey vessels • Support vessels • Fuel bunkering vessels

Potential risks to commercial fishing and proposed mitigation measures:

Potential Risk and/or Impact	Mitigation and/or Management Measure

Planned activities	
Interests of relevant stakeholders with respect to: • Defence activities • Petroleum activities • Commercial 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 EP. • Advice to relevant stakeholders prior to the commencement of activities. • All vessels within the Scarborough activity area will adhere to the navigation safety requirements including the Navigation Act 2012 and any subsequent Marine Orders.
Marine fauna interactions	• Vessel masters will implement interaction management actions in accordance with the EPBC Regulations 2000. • The dredging vessel will have trained crew as marine fauna observers and adhere to the observation and exclusion zones.
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	• Infrastructure will be positioned on the seabed within design footprint to reduce seabed disturbance. • Bathymetric and other surveys will be undertaken to monitor seabed characteristics before and after activities. • A management framework for dredging and backfill activities based on water quality will be developed. • Dredging and spoil disposal activities will be undertaken in compliance with a sea dumping permit. • A minimum 250 m buffer from the Dampier Marine Park boundaries will be in place for the borrow ground dredging activities.
Vessel interaction	• Woodside will notify relevant fishery stakeholders and government maritime safety agencies of specific start and end dates, specific vessel-on-location dates and any exclusion zones prior to commencement of the activity.
Waste management	• 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 accidental loss to the environment. • Wastes transported onshore will be sent to appropriate recycling or disposal facilities by a licensed waste contractor.
Unplanned activities	
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.

	• Contracted vessels comply with Australian ballast water requirements.

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 1800 442 977.

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 30 September 2021.

Regards

Graduate Corporate Affairs Adviser | Operations

1.11 Email sent to Commonwealth fisheries licence holders (North West Slope Trawl Fishery, Western Deepwater Trawl, Western Skipjack, Northern Prawn, Western Tuna and Billfish, Southern Bluefin Tuna) (31 August 2021)

Dear Licence Holder

Woodside is planning to submit an Environment Plan (EP) to undertake seabed intervention and trunkline installation activities in Commonwealth waters for the Scarborough development, in accordance with the Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2009 (Cth).

This EP falls under the primary environmental approval of the Scarborough Offshore Project Proposal (OPP) and will be conducted in line with relevant requirements of the OPP. The OPP includes a detailed description of activities and an assessment of impacts; with controls to develop acceptability criteria. It was accepted by NOPSEMA in March 2020 after an extensive public consultation process. Woodside is proposing four Commonwealth EPs for the Scarborough development to be submitted to NOPSEMA in the next two years, and will consult with all relevant stakeholders ahead of each EP.

A separate EP is planned to address Trunkline installation and seabed intervention activities in State waters, for approval by the Western Australian Department of Mines, Industry Regulation and Safety. The location of the proposed Trunkline in State waters is shown on the Consultation Information Sheet.

Seabed intervention activities are planned to commence in 2022 and trunkline installation activities in 2023, pending approvals, vessel availability and weather constraints, in water depths ranging from approximately 32 m to 1400 m.

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 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. Based on AFMA advice, Woodside is consulting with all Commonwealth fishery licence holders with entitlements to fish in the area.

More information on the Scarborough development can be found here.

Activity:

Summary:	Seabed intervention and Trunkline installation activities in Commonwealth waters for the Scarborough development.
Location:	Activities run from the Commonwealth – State waters boundary approximately 32 km north of Dampier to the Scarborough gas field located at Woodside-operated title block WA-61-L, approximately 375 km west-northwest of the Burrup Peninsula.
Approx. Water Depth (m):	~ 32 m – 1400 m
Earliest commencement date:	Seabed intervention activities: Q4 2022 pending approvals, vessel availability and weather constraints. Trunkline installation activities: Q4 2023 pending successful completion of State waters installation scope, approvals, vessel availability and weather constraints.
Estimated duration:	Approximately 24 months across multiple campaigns.
Distance from Operational Area to nearest port/marina	Eastern end of the Trunkline route overlaps with the Pilbara Port Authority Dampier Port Limits
Distance from Operational Area to nearest marine park	• The trunkline corridor runs through the Montebello Marine Park – Multiple Use Zone (Cth), close to the northern boundary. • Offshore borrow ground located to the north of the Dampier Marine Park Habitat Protection Zone. A minimum 250 m buffer will be in place from the Marine Park boundaries.
Operational Areas	• **Scarborough Trunkline Project Area**: The proposed Trunkline from the Scarborough FPU (approximately 430 km north-west of the Burrup) to the State waters boundary and 1.5 km either side of the proposed Trunkline centreline to allow for the movement and positioning of vessels. This also includes Spoil Ground 5A, which is approximately 300 m wide and runs ~17 km from the State waters boundary. • **Offshore Borrow Ground Project Area**: Offshore Borrow Ground (location where sand will be sourced). The Offshore Borrow Ground is approximately 17 km^2, located 20 km to the east of the proposed Trunkline route and adjacent to the Dampier Marine Park.
Relevant Fisheries	**Commonwealth:** North-West Slope Trawl Fishery **State:** Mackerel Managed Fishery (Area 2 and 3), Pilbara Crab Managed Fishery, Nickol Bay Prawn Managed Fishery, Pilbara Trawl Fishery, Pilbara Trap Fishery, Pilbara Line Fishery, Marine Aquarium Fishery and Specimen Shell Fishery.

*Additional Fisheries (*Consultation based on AFMA advice to consult all fisheries with entitlements to fish in the area)*	**Commonwealth:** Western Deepwater Trawl Fishery, Western Skipjack Fishery, Southern Bluefin Tuna Fishery, Western Tuna and Billfish Fishery
Exclusionary/Cautionary Zone:	Temporary safety exclusion zones will be confirmed prior to the activity commencing and will be issued with notifications to mariners at the time of the activity. The temporary exclusion zones will likely range between 500 – 1500 m depending on the vessel type and activity being carried out.
Vessels:	• Trailing suction hopper dredge (TSHD) • Offshore construction vessel (OCV) • Fall pipe vessel (rock dump) • Primary Installation Vessel (PIV) multi-joint operation • Shallow Water Lay Barge (SWLB) • Anchor handling vessel/tug • Pipe supply vessels • Survey vessels • Support vessels • Fuel bunkering vessels

Potential risks to commercial fishing and proposed mitigation measures:

Potential Risk and/or Impact	Mitigation and/or Management Measure
Planned activities	
Interests of relevant stakeholders with respect to: • Defence activities • Petroleum activities • Commercial 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 EP. • Advice to relevant stakeholders prior to the commencement of activities. • All vessels within the Scarborough activity area will adhere to the navigation safety requirements including the Navigation Act 2012 and any subsequent Marine Orders.
Marine fauna interactions	• Vessel masters will implement interaction management actions in accordance with the EPBC Regulations 2000. • The dredging vessel will have trained crew as marine fauna observers and adhere to the observation and exclusion zones.
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	• Infrastructure will be positioned on the seabed within design footprint to reduce seabed disturbance. • Bathymetric and other surveys will be undertaken to monitor seabed characteristics before and after activities. • A management framework for dredging and backfill activities based on water quality will be developed.

	• Dredging and spoil disposal activities will be undertaken in compliance with a sea dumping permit. • A minimum 250 m buffer from the Dampier Marine Park boundaries will be in place for the borrow ground dredging activities.
Vessel interaction	• Woodside will notify relevant fishery stakeholders and government maritime safety agencies of specific start and end dates, specific vessel-on-location dates and any exclusion zones prior to commencement of the activity.
Waste management	• 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 accidental loss to the environment. • Wastes transported onshore will be sent to appropriate recycling or disposal facilities by a licensed waste contractor.
Unplanned activities	
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. • Contracted vessels comply with Australian ballast water requirements.

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 1800 442 977.

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 30 September 2021.

Regards

Graduate Corporate Affairs Adviser | Operations

1.12 Letter sent to licence holders (Mackerel Areas 2 and 3, Pilbara Crab, Marine Aquarium, Specimen Shell, Nickol Bay Prawn, Southern Bluefin Tuna) (1 September 2021)

31 August 2021

Dear Licence Holder

WOODSIDE CONSULTATION - SCARBOROUGH SEABED INTERVENTION AND TRUNKLINE INSTALLATION ENVIRONMENT PLAN

Woodside is planning to submit an Environment Plan (EP) to undertake seabed intervention and trunkline installation activities in Commonwealth waters for the Scarborough development, in accordance with the Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2009 (Cth).

This EP falls under the primary environmental approval of the Scarborough Offshore Project Proposal (OPP) and will be conducted in line with relevant requirements of the OPP. The OPP includes a detailed description of activities and an assessment of impacts; with controls to develop acceptability criteria. It was accepted by NOPSEMA in March 2020 after an extensive public consultation process. Woodside is proposing four Commonwealth EPs for the Scarborough development to be submitted to NOPSEMA in the next two years, and will consult with all relevant stakeholders ahead of each EP.

A separate EP is planned to address Trunkline installation and seabed intervention activities in State waters, for approval by the Western Australian Department of Mines, Industry Regulation and Safety. The location of the proposed Trunkline in State waters is shown on the Consultation Information Sheet.

Seabed intervention activities are planned to commence in 2022 and trunkline installation activities in 2023, pending approvals, vessel availability and weather constraints, in water depths ranging from approximately 32 m to 1400 m.

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 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. Based on AFMA advice, Woodside is consulting with all Commonwealth fishery licence holders with entitlements to fish in the area.
More information on the Scarborough development can be found on our website.

Activity:

Summary:	Seabed intervention and Trunkline installation activities in Commonwealth waters for the Scarborough development.
Location:	Activities run from the Commonwealth – State waters boundary approximately 32 km north of Dampier to the Scarborough gas field located at Woodside-operated title block WA-61-L, approximately 375 km west-northwest of the Burrup Peninsula.
Approx. Water Depth (m):	~ 32 m – 1400 m
Earliest commencement date:	Seabed intervention activities: Q4 2022 pending approvals, vessel availability and weather constraints. Trunkline installation activities: Q4 2023 pending successful completion of State waters installation scope, approvals, vessel availability and weather constraints.
Estimated duration:	Approximately 24 months across multiple campaigns.

Distance from Operational Area to nearest port/marina	Eastern end of the Trunkline route overlaps with the Pilbara Port Authority Dampier Port Limits
Distance from Operational Area to nearest marine park	• The trunkline corridor runs through the Montebello Marine Park – Multiple Use Zone (Cth), close to the northern boundary. • Offshore borrow ground located to the north of the Dampier Marine Park Habitat Protection Zone. A minimum 250 m buffer will be in place from the Marine Park boundaries.
Operational Areas	• **Scarborough Trunkline Project Area**: The proposed Trunkline from the Scarborough FPU (approximately 430 km north-west of the Burrup) to the State waters boundary and 1.5 km either side of the proposed Trunkline centreline to allow for the movement and positioning of vessels. This also includes Spoil Ground 5A, which is approximately 300 m wide and runs ~17 km from the State waters boundary. • **Offshore Borrow Ground Project Area**: Offshore Borrow Ground (location where sand will be sourced). The Offshore Borrow Ground is approximately 17 km^2, located 20 km to the east of the proposed Trunkline route and adjacent to the Dampier Marine Park.
Relevant Fisheries	**Commonwealth:** North-West Slope Trawl Fishery **State:** Mackerel Managed Fishery (Area 2 and 3), Pilbara Crab Managed Fishery, Nickol Bay Prawn Managed Fishery, Pilbara Trawl Fishery, Pilbara Trap Fishery, Pilbara Line Fishery, Marine Aquarium Fishery and Specimen Shell Fishery.
*Additional Fisheries (*Consultation based on AFMA advice to consult all fisheries with entitlements to fish in the area)*	**Commonwealth:** Western Deepwater Trawl Fishery, Western Skipjack Fishery, Southern Bluefin Tuna Fishery, Western Tuna and Billfish Fishery
Exclusionary/Cautionary Zone:	Temporary safety exclusion zones will be confirmed prior to the activity commencing and will be issued with notifications to mariners at the time of the activity. The temporary exclusion zones will likely range between 500 – 1500 m depending on the vessel type and activity being carried out.
Vessels:	• Trailing suction hopper dredge (TSHD) • Offshore construction vessel (OCV) • Fall pipe vessel (rock dump) • Primary Installation Vessel (PIV) multi-joint operation • Shallow Water Lay Barge (SWLB) • Anchor handling vessel/tug • Pipe supply vessels • Survey vessels • Support vessels • Fuel bunkering vessels

Potential risks to commercial fishing and proposed mitigation measures:

Potential Risk and/or Impact	Mitigation and/or Management Measure
Planned activities	
Interests of relevant stakeholders with respect to: • Defence 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 EP. • Advice to relevant stakeholders prior to the commencement of activities.

• Petroleum activities • Commercial fishing activities • Shipping activities	• All vessels within the Scarborough activity area will adhere to the navigation safety requirements including the Navigation Act 2012 and any subsequent Marine Orders.
Marine fauna interactions	• Vessel masters will implement interaction management actions in accordance with the EPBC Regulations 2000. • The dredging vessel will have trained crew as marine fauna observers and adhere to the observation and exclusion zones.
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	• Infrastructure will be positioned on the seabed within design footprint to reduce seabed disturbance. • Bathymetric and other surveys will be undertaken to monitor seabed characteristics before and after activities. • A management framework for dredging and backfill activities based on water quality will be developed. • Dredging and spoil disposal activities will be undertaken in compliance with a sea dumping permit. • A minimum 250 m buffer from the Dampier Marine Park boundaries will be in place for the borrow ground dredging activities.
Vessel interaction	• Woodside will notify relevant fishery stakeholders and government maritime safety agencies of specific start and end dates, specific vessel-on-location dates and any exclusion zones prior to commencement of the activity.
Waste management	• 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 accidental loss to the environment. • Wastes transported onshore will be sent to appropriate recycling or disposal facilities by a licensed waste contractor.
Unplanned activities	
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. • Contracted vessels comply with Australian ballast water requirements.

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 1800 442 977.

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 30 September 2021.

Regards

Graduate Corporate Affairs Adviser
Attached: Consultation Information Sheet and Fishery Map

1.13 Email sent to DPIRD (31 August 2021)

Dear [redacted]

Woodside is planning to submit an Environment Plan (EP) to undertake seabed intervention and trunkline installation activities in Commonwealth waters for the Scarborough development, in accordance with the Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2009 (Cth).

We have identified potential impacts to commercial fishers and the environment and are currently working to reduce these risks to as low as reasonably practicable as we develop the EP. These risks are summarised below.

An information sheet (also on our website) and map of relevant fisheries are attached.

This EP falls under the primary environmental approval of the Scarborough Offshore Project Proposal (OPP) and will be conducted in line with relevant requirements of the OPP. The OPP includes a detailed description of activities and an assessment of impacts; with controls to develop acceptability criteria. It was accepted by NOPSEMA in March 2020 after an extensive public consultation process. Woodside is proposing four Commonwealth EPs for the Scarborough development to be submitted to NOPSEMA in the next two years, and will consult with all relevant stakeholders ahead of each EP.

A separate EP is planned to address Trunkline installation and seabed intervention activities in State waters, for approval by the Western Australian Department of Mines, Industry Regulation and Safety. The location of the proposed Trunkline in State waters is shown on the Consultation Information Sheet.
More information on the Scarborough development can be found here.
Activity:

Summary:	Seabed intervention and Trunkline installation activities in Commonwealth waters for the Scarborough development.
Location:	Activities run from the Commonwealth – State waters boundary approximately 32 km north of Dampier to the Scarborough gas field located at Woodside-operated title block WA-61-L, approximately 375 km west-northwest of the Burrup Peninsula.
Approx. Water Depth (m):	~ 32 m – 1400 m
Earliest commencement date:	Seabed intervention activities: Q4 2022 pending approvals, vessel availability and weather constraints. Trunkline installation activities: Q4 2023 pending successful completion of State waters installation scope, approvals, vessel availability and weather constraints.
Estimated duration:	Approximately 24 months across multiple campaigns.

Distance from Operational Area to nearest port/marina	Eastern end of the Trunkline route overlaps with the Pilbara Port Authority Dampier Port Limits
Distance from Operational Area to nearest marine park	• The trunkline corridor runs through the Montebello Marine Park – Multiple Use Zone (Cth), close to the northern boundary. • Offshore borrow ground located to the north of the Dampier Marine Park Habitat Protection Zone. A minimum 250 m buffer will be in place from the Marine Park boundaries.
Operational Areas	• **Scarborough Trunkline Project Area**: The proposed Trunkline from the Scarborough FPU (approximately 430 km north-west of the Burrup) to the State waters boundary and 1.5 km either side of the proposed Trunkline centreline to allow for the movement and positioning of vessels. This also includes Spoil Ground 5A, which is approximately 300 m wide and runs ~17 km from the State waters boundary. • **Offshore Borrow Ground Project Area**: Offshore Borrow Ground (location where sand will be sourced). The Offshore Borrow Ground is approximately 17 km^2, located 20 km to the east of the proposed Trunkline route and adjacent to the Dampier Marine Park.
Relevant Fisheries	**Commonwealth:** North-West Slope Trawl Fishery **State:** Mackerel Managed Fishery (Area 2 and 3), Pilbara Crab Managed Fishery, Nickol Bay Prawn Managed Fishery, Pilbara Trawl Fishery, Pilbara Trap Fishery, Pilbara Line Fishery, Marine Aquarium Fishery and Specimen Shell Fishery.
*Additional Fisheries (*Consultation based on AFMA advice to consult all fisheries with entitlements to fish in the area)*	**Commonwealth:** Western Deepwater Trawl Fishery, Western Skipjack Fishery, Southern Bluefin Tuna Fishery, Western Tuna and Billfish Fishery
Relevant State Fisheries	Mackerel Managed Fishery (Area 2 and 3), Pilbara Crab Managed Fishery, Nickol Bay Prawn Managed Fishery, Pilbara Trawl Fishery, Pilbara Trap Fishery, Pilbara Line Fishery, Marine Aquarium Fishery and Specimen Shell Fishery
Exclusionary/Cautionary Zone:	Temporary safety exclusion zones will be confirmed prior to the activity commencing and will be issued with notifications to mariners at the time of the activity. The temporary exclusion zones will likely range between 500 – 1500 m depending on the vessel type and activity being carried out.
Vessels:	• Trailing suction hopper dredge (TSHD) • Offshore construction vessel (OCV) • Fall pipe vessel (rock dump) • Primary Installation Vessel (PIV) multi-joint operation • Shallow Water Lay Barge (SWLB) • Anchor handling vessel/tug • Pipe supply vessels • Survey vessels

- Support vessels
- Fuel bunkering vessels

Potential risks to commercial fishing and proposed mitigation measures:

Potential Risk and/or Impact	Mitigation and/or Management Measure
Planned activities	
Interests of relevant stakeholders with respect to: • Defence activities • Petroleum activities • Commercial 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 EP. • Advice to relevant stakeholders prior to the commencement of activities. • All vessels within the Scarborough activity area will adhere to the navigation safety requirements including the Navigation Act 2012 and any subsequent Marine Orders.
Marine fauna interactions	• Vessel masters will implement interaction management actions in accordance with the EPBC Regulations 2000. • The dredging vessel will have trained crew as marine fauna observers and adhere to the observation and exclusion zones.
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	• Infrastructure will be positioned on the seabed within design footprint to reduce seabed disturbance. • Bathymetric and other surveys will be undertaken to monitor seabed characteristics before and after activities. • A management framework for dredging and backfill activities based on water quality will be developed. • Dredging and spoil disposal activities will be undertaken in compliance with a sea dumping permit. • A minimum 250 m buffer from the Dampier Marine Park boundaries will be in place for the borrow ground dredging activities.
Vessel interaction	• Woodside will notify relevant fishery stakeholders and government maritime safety agencies of specific start and end dates, specific vessel-on-location dates and any exclusion zones prior to commencement of the activity.
Waste management	• 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 accidental loss to the environment. • Wastes transported onshore will be sent to appropriate recycling or disposal facilities by a licensed waste contractor.
Unplanned activities	
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. • Contracted vessels comply with Australian ballast water requirements.

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 1800 442 977.

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 30 September 2021.

Regards

Graduate Corporate Affairs Adviser | Operations

1.14 Email sent to Karratha Charter Operators and WA Game Fishing Association (31 August 2021)

Dear Stakeholder

Woodside is planning to submit an Environment Plan (EP) to undertake seabed intervention and trunkline installation activities in Commonwealth waters for the Scarborough development, in accordance with the Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2009 (Cth).

A Consultation Information Sheet is attached, which provides background on the proposed activity, including a summary of potential key risk and associated management measures. It is also available on our website.

This EP falls under the primary environmental approval of the Scarborough Offshore Project Proposal (OPP) and will be conducted in line with relevant requirements of the OPP. The OPP includes a detailed description of activities and an assessment of impacts; with controls to develop acceptability criteria. It was accepted by NOPSEMA in March 2020 after an extensive public consultation process. Woodside is proposing four Commonwealth EPs for the Scarborough development to be submitted to NOPSEMA in the next two years, and will consult with all relevant stakeholders ahead of each EP.

A separate EP is planned to address Trunkline installation and seabed intervention activities in State waters, for approval by the Western Australian Department of Mines, Industry Regulation and Safety. The location of the proposed Trunkline in State waters is shown on the Consultation Information Sheet.
More information on the Scarborough development can be found here.
Activity:

Summary:	Seabed intervention and Trunkline installation activities in Commonwealth waters for the Scarborough development.
Location:	Activities run from the Commonwealth – State waters boundary approximately 32 km north of Dampier to the Scarborough gas field located at Woodside-operated title block WA-61-L, approximately 375 km west-northwest of the Burrup Peninsula.
Approx. Water Depth (m):	~ 32 m – 1400 m
Earliest commencement date:	Seabed intervention activities: Q4 2022 pending approvals, vessel availability and weather constraints Trunkline installation activities: Q4 2023 pending successful completion of State waters installation scope, approvals, vessel availability and weather constraints.
Estimated duration:	Approximately 24 months across multiple campaigns
Distance from Operational Area to nearest port/marina	Eastern end of the Trunkline route overlaps with the Pilbara Port Authority Dampier Port Limits
Distance from Operational Area to nearest marine park	• The trunkline corridor runs through the Montebello Marine Park – Multiple Use Zone (Cth), close to the northern boundary. • Offshore borrow ground located to the north of the Dampier Marine Park Habitat Protection Zone. A minimum 250 m buffer will be in place from the Marine Park boundaries.
Operational Areas	• **Scarborough Trunkline Project Area**: The proposed Trunkline from the Scarborough FPU (approximately 430 km north-west of the Burrup) to the State waters boundary and 1.5 km either side of the proposed Trunkline centreline to allow for the movement and positioning of vessels. This also includes Spoil Ground 5A, which is approximately 300 m wide and runs ~17 km from the State waters boundary. • **Offshore Borrow Ground Project Area**: Offshore Borrow Ground (location where sand will be sourced). The Offshore Borrow Ground is approximately 17 km^2, located 20 km to the east of the proposed Trunkline route and adjacent to the Dampier Marine Park.
Vessels:	• Trailing suction hopper dredge (TSHD) • Offshore construction vessel (OCV) • Fall pipe vessel (rock dump) • Primary Installation Vessel (PIV) multi-joint operation • Shallow Water Lay Barge (SWLB) • Anchor handling vessel/tug • Pipe supply vessels • Survey vessels • Support vessels • Fuel bunkering vessels

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 1800 442 977.

Your feedback and our response will be included in our Environment Plan 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 30 September 2021.

Regards

Graduate Corporate Affairs Adviser | Operations

1.15 Email sent to Pearl Producers Association (31 August 2021)

Dear [redacted]

Woodside is planning to submit an Environment Plan (EP) to undertake seabed intervention and trunkline installation activities in Commonwealth waters for the Scarborough development, in accordance with the Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2009 (Cth).

A Consultation Information Sheet is attached, which provides background on the proposed activity, including a summary of potential key risk and associated management measures. It is also available on our website.

This EP falls under the primary environmental approval of the Scarborough Offshore Project Proposal (OPP) and will be conducted in line with relevant requirements of the OPP. The OPP includes a detailed description of activities and an assessment of impacts; with controls to develop acceptability criteria. It was accepted by NOPSEMA in March 2020 after an extensive public consultation process. Woodside is proposing four Commonwealth EPs for the Scarborough development to be submitted to NOPSEMA in the next two years, and will consult with all relevant stakeholders ahead of each EP.

A separate EP is planned to address Trunkline installation and seabed intervention activities in State waters, for approval by the Western Australian Department of Mines, Industry Regulation and Safety. The location of the proposed Trunkline in State waters is shown on the Consultation Information Sheet.
More information on the Scarborough development can be found here.
Activity:

Summary:	Seabed intervention and Trunkline installation activities in Commonwealth waters for the Scarborough development.
Location:	Activities run from the Commonwealth – State waters boundary approximately 32 km north of Dampier to the Scarborough gas field located at Woodside-operated title block WA-61-L, approximately 375 km west-northwest of the Burrup Peninsula.
Approx. Water Depth (m):	~ 32 m – 1400 m
Earliest commencement date:	Seabed intervention activities: Q4 2022 pending approvals, vessel availability and weather constraints

	Trunkline installation activities: Q4 2023 pending successful completion of State waters installation scope, approvals, vessel availability and weather constraints.
Estimated duration:	Approximately 24 months across multiple campaigns
Distance from Operational Area to nearest port/marina	Eastern end of the Trunkline route overlaps with the Pilbara Port Authority Dampier Port Limits
Distance from Operational Area to nearest marine park	• The trunkline corridor runs through the Montebello Marine Park – Multiple Use Zone (Cth), close to the northern boundary. • Offshore borrow ground located to the north of the Dampier Marine Park Habitat Protection Zone. A minimum 250 m buffer will be in place from the Marine Park boundaries.
Operational Areas	• **Scarborough Trunkline Project Area**: The proposed Trunkline from the Scarborough FPU (approximately 430 km north-west of the Burrup) to the State waters boundary and 1.5 km either side of the proposed Trunkline centreline to allow for the movement and positioning of vessels. This also includes Spoil Ground 5A, which is approximately 300 m wide and runs ~17 km from the State waters boundary. • **Offshore Borrow Ground Project Area**: Offshore Borrow Ground (location where sand will be sourced). The Offshore Borrow Ground is approximately 17 km^2, located 20 km to the east of the proposed Trunkline route and adjacent to the Dampier Marine Park.
Exclusionary/Cautionary Zone:	Temporary safety exclusion zones will be confirmed prior to the activity commencing and will be issued with notifications to mariners at the time of the activity. The temporary exclusion zones will likely range between 500 – 1500 m depending on the vessel type and activity being carried out.
Vessels:	• Trailing suction hopper dredge (TSHD) • Offshore construction vessel (OCV) • Fall pipe vessel (rock dump) • Primary Installation Vessel (PIV) multi-joint operation • Shallow Water Lay Barge (SWLB) • Anchor handling vessel/tug • Pipe supply vessels • Survey vessels • Support vessels • Fuel bunkering vessels

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 1800 442 977.

Your feedback and our response will be included in our Environment Plan 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 30 September 2021.

Regards

Graduate Corporate Affairs Adviser | Operations

1.16 Email sent to AFMA and CFA (31 August 2021)

Dear Stakeholder

Woodside is planning to submit an Environment Plan (EP) to undertake seabed intervention and trunkline installation activities in Commonwealth waters for the Scarborough development, in accordance with the Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2009 (Cth).

We have identified potential impacts to commercial fishers and the environment and are currently working to reduce these risks to as low as reasonably practicable as we develop the EP. These risks are summarised below.

An information sheet (also on our website) and map of relevant fisheries are attached.
This EP falls under the primary environmental approval of the Scarborough Offshore Project Proposal (OPP) and will be conducted in line with relevant requirements of the OPP. The OPP includes a detailed description of activities and an assessment of impacts; with controls to develop acceptability criteria. It was accepted by NOPSEMA in March 2020 after an extensive public consultation process. Woodside is proposing four Commonwealth EPs for the Scarborough development to be submitted to NOPSEMA in the next two years, and will consult with all relevant stakeholders ahead of each EP.

A separate EP is planned to address Trunkline installation and seabed intervention activities in State waters, for approval by the Western Australian Department of Mines, Industry Regulation and Safety. The location of the proposed Trunkline in State waters is shown on the Consultation Information Sheet.

More information on the Scarborough development can be found here.
Activity:

Summary:	Seabed intervention and Trunkline installation activities in Commonwealth waters for the Scarborough development.
Location:	Activities run from the Commonwealth – State waters boundary approximately 32 km north of Dampier to the Scarborough gas field located at Woodside-operated title block WA-61-L, approximately 375 km west-northwest of the Burrup Peninsula.
Approx. Water Depth (m):	~ 32 m – 1400 m
Earliest commencement date:	Seabed intervention activities: Q4 2022 pending approvals, vessel availability and weather constraints. Trunkline installation activities: Q4 2023 pending successful completion of State waters installation scope, approvals, vessel availability and weather constraints.
Estimated duration:	Approximately 24 months across multiple campaigns.
Distance from Operational Area to nearest port/marina	Eastern end of the Trunkline route overlaps with the Pilbara Port Authority Dampier Port Limits

Distance from Operational Area to nearest marine park	• The trunkline corridor runs through the Montebello Marine Park – Multiple Use Zone (Cth), close to the northern boundary. • Offshore borrow ground located to the north of the Dampier Marine Park Habitat Protection Zone. A minimum 250 m buffer will be in place from the Marine Park boundaries.
Operational Areas	• **Scarborough Trunkline Project Area**: The proposed Trunkline from the Scarborough FPU (approximately 430 km north-west of the Burrup) to the State waters boundary and 1.5 km either side of the proposed Trunkline centreline to allow for the movement and positioning of vessels. This also includes Spoil Ground 5A, which is approximately 300 m wide and runs ~17 km from the State waters boundary. • **Offshore Borrow Ground Project Area**: Offshore Borrow Ground (location where sand will be sourced). The Offshore Borrow Ground is approximately 17 km^2, located 20 km to the east of the proposed Trunkline route and adjacent to the Dampier Marine Park.
Relevant Fisheries	**Commonwealth:** North-West Slope Trawl Fishery **State:** Mackerel Managed Fishery (Area 2 and 3), Pilbara Crab Managed Fishery, Nickol Bay Prawn Managed Fishery, Pilbara Trawl Fishery, Pilbara Trap Fishery, Pilbara Line Fishery, Marine Aquarium Fishery and Specimen Shell Fishery.
*Additional Fisheries (*Consultation based on AFMA advice to consult all fisheries with entitlements to fish in the area)*	**Commonwealth:** Western Deepwater Trawl Fishery, Western Skipjack Fishery, Southern Bluefin Tuna Fishery, Western Tuna and Billfish Fishery
Relevant Commonwealth Fisheries	North-West Slope Trawl Fishery
*Additional Fisheries (*Consultation based on AFMA advice to consult all fisheries with entitlements to fish in the area)*	Western Deepwater Trawl Fishery, Western Skipjack Fishery, Southern Bluefin Tuna Fishery, Western Tuna and Billfish Fishery
Vessels:	• Trailing suction hopper dredge (TSHD) • Offshore construction vessel (OCV) • Fall pipe vessel (rock dump) • Primary Installation Vessel (PIV) multi-joint operation • Shallow Water Lay Barge (SWLB) • Anchor handling vessel/tug • Pipe supply vessels • Survey vessels • Support vessels • Fuel bunkering vessels

Potential risks to commercial fishing and proposed mitigation measures:

Potential Risk and/or Impact	Mitigation and/or Management Measure
Planned activities	
Interests of relevant stakeholders with respect to: • Defence activities • Petroleum activities • Commercial 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 EP. • Advice to relevant stakeholders prior to the commencement of activities. • All vessels within the Scarborough activity area will adhere to the navigation safety requirements including the Navigation Act 2012 and any subsequent Marine Orders.
Marine fauna interactions	• Vessel masters will implement interaction management actions in accordance with the EPBC Regulations 2000. • The dredging vessel will have trained crew as marine fauna observers and adhere to the observation and exclusion zones.
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	• Infrastructure will be positioned on the seabed within design footprint to reduce seabed disturbance. • Bathymetric and other surveys will be undertaken to monitor seabed characteristics before and after activities. • A management framework for dredging and backfill activities based on water quality will be developed. • Dredging and spoil disposal activities will be undertaken in compliance with a sea dumping permit. • A minimum 250 m buffer from the Dampier Marine Park boundaries will be in place for the borrow ground dredging activities.
Vessel interaction	• Woodside will notify relevant fishery stakeholders and government maritime safety agencies of specific start and end dates, specific vessel-on-location dates and any exclusion zones prior to commencement of the activity.
Waste management	• 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 accidental loss to the environment. • Wastes transported onshore will be sent to appropriate recycling or disposal facilities by a licensed waste contractor.
Unplanned activities	
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. • Contracted vessels comply with Australian ballast water requirements.

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 1800 442 977.

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 30 September 2021.

Regards

Graduate Corporate Affairs Adviser | Operations

1.17 Email sent to Chevron, Santos, Western Gas, Vermilion Energy, KUFPC, Jadestone Energy (31 August 2021)

Dear Titleholder,

Woodside is planning to submit an Environment Plan (EP) to undertake seabed intervention and trunkline installation activities in Commonwealth waters for the Scarborough development, in accordance with the Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2009 (Cth).

A Consultation Information Sheet is attached, which provides background on the proposed activity, including a summary of potential key risk and associated management measures. The Information Sheet is also available on our website. A map showing the proposed activity relevant to adjacent petroleum titles is also attached.

This EP falls under the primary environmental approval of the Scarborough Offshore Project Proposal (OPP) and will be conducted in line with relevant requirements of the OPP. The OPP includes a detailed description of activities and an assessment of impacts; with controls to develop acceptability criteria. It was accepted by NOPSEMA in March 2020 after an extensive public consultation process. Woodside is proposing four Commonwealth EPs for the Scarborough development to be submitted to NOPSEMA in the next two years, and will consult with all relevant stakeholders ahead of each EP.

A separate EP is planned to address Trunkline installation and seabed intervention activities in State waters, for approval by the Western Australian Department of Mines, Industry Regulation and Safety. The location of the proposed Trunkline in State waters is shown on the Consultation Information Sheet.

More information on the Scarborough development can be found here.

Activity:

Summary:	Seabed intervention and Trunkline installation activities in Commonwealth waters for the Scarborough development.

Location:	Activities run from the Commonwealth – State waters boundary approximately 32 km north of Dampier to the Scarborough gas field located at Woodside-operated title block WA-61-L, approximately 375 km west-northwest of the Burrup Peninsula.
Approx. Water Depth (m):	~ 32 m – 1400 m
Earliest commencement date:	Seabed intervention activities: Q4 2022 pending approvals, vessel availability and weather constraints Trunkline installation activities: Q4 2023 pending successful completion of State waters installation scope, approvals, vessel availability and weather constraints.
Estimated duration:	Approximately 24 months across multiple campaigns
Distance from Operational Area to nearest port/marina	Eastern end of the Trunkline route overlaps with the Pilbara Port Authority Dampier Port Limits
Distance from Operational Area to nearest marine park	• The trunkline corridor runs through the Montebello Marine Park – Multiple Use Zone (Cth), close to the northern boundary. • Offshore borrow ground located to the north of the Dampier Marine Park Habitat Protection Zone. A minimum 250 m buffer will be in place from the Marine Park boundaries.
Operational Areas	• **Scarborough Trunkline Project Area**: The proposed Trunkline from the Scarborough FPU (approximately 430 km north-west of the Burrup) to the State waters boundary and 1.5 km either side of the proposed Trunkline centreline to allow for the movement and positioning of vessels. This also includes Spoil Ground 5A, which is approximately 300 m wide and runs ~17 km from the State waters boundary. • **Offshore Borrow Ground Project Area**: Offshore Borrow Ground (location where sand will be sourced). The Offshore Borrow Ground is approximately 17 km^2, located 20 km to the east of the proposed Trunkline route and adjacent to the Dampier Marine Park.
Vessels:	• Trailing suction hopper dredge (TSHD) • Offshore construction vessel (OCV) • Fall pipe vessel (rock dump) • Primary Installation Vessel (PIV) multi-joint operation • Shallow Water Lay Barge (SWLB) • Anchor handling vessel/tug • Pipe supply vessels • Survey vessels • Support vessels • Fuel bunkering vessels

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 1800 442 977.

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).

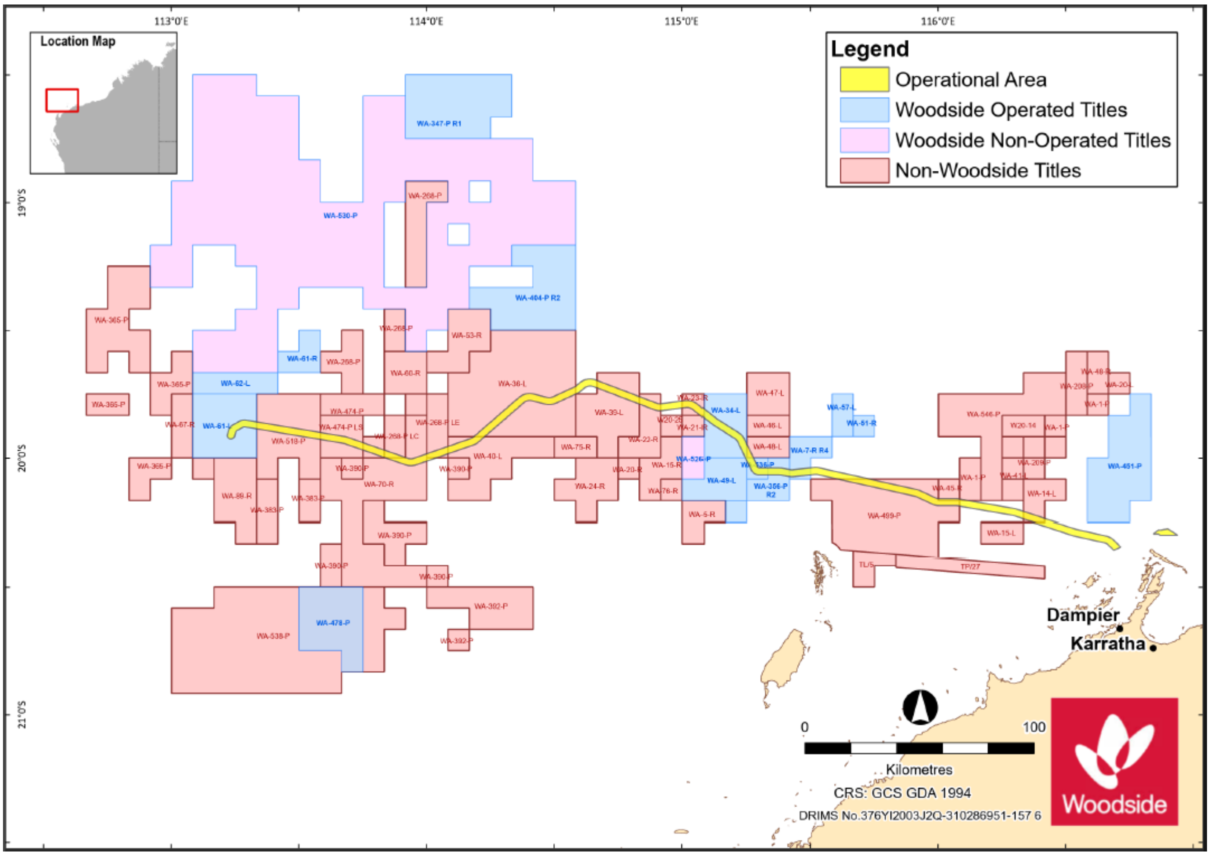
Please let us know if your feedback for this activity is sensitive and we will make this known to NOPSEMA upon submission of the Environment Plan in order for this information to remain confidential to NOPSEMA.

Please provide your views by 30 September 2021.

Regards

Graduate Corporate Affairs Adviser | Operations

1.18 Titleholders map sent to Chevron, Santos, Western Gas, Vermilion Energy, KUFPEC, Jadestone Energy (31 August 2021)



1.19 Email sent to Southern Bluefin Tuna Industry Association (31 August 2021)

Dear Stakeholder

Woodside is planning to submit an Environment Plan (EP) to undertake seabed intervention and trunkline installation activities in Commonwealth waters for the Scarborough development, in accordance with the Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2009 (Cth).

We have identified potential impacts to commercial fishers and the environment and are currently working to reduce these risks to as low as reasonably practicable as we develop the EP. These risks are summarised below.

An information sheet (also on our website) and map of relevant fisheries are attached.
This EP falls under the primary environmental approval of the Scarborough Offshore Project Proposal (OPP) and will be conducted in line with relevant requirements of the OPP. The OPP includes a detailed description of activities and an assessment of impacts; with controls to develop acceptability criteria. It was accepted by NOPSEMA in March 2020 after an extensive public consultation process. Woodside is proposing four Commonwealth EPs for the Scarborough development to be submitted to NOPSEMA in the next two years, and will consult with all relevant stakeholders ahead of each EP.

A separate EP is planned to address Trunkline installation and seabed intervention activities in State waters, for approval by the Western Australian Department of Mines, Industry Regulation and Safety. The location of the proposed Trunkline in State waters is shown on the Consultation Information Sheet.
More information on the Scarborough development can be found here.

Activity:

Summary:	Seabed intervention and Trunkline installation activities in Commonwealth waters for the Scarborough development.
Location:	Activities run from the Commonwealth – State waters boundary approximately 32 km north of Dampier to the Scarborough gas field located at Woodside-operated title block WA-61-L, approximately 375 km west-northwest of the Burrup Peninsula.
Approx. Water Depth (m):	~ 32 m – 1400 m
Earliest commencement date:	Seabed intervention activities: Q4 2022 pending approvals, vessel availability and weather constraints. Trunkline installation activities: Q4 2023 pending successful completion of State waters installation scope, approvals, vessel availability and weather constraints.
Estimated duration:	Approximately 24 months across multiple campaigns.
Distance from Operational Area to nearest port/marina	Eastern end of the Trunkline route overlaps with the Pilbara Port Authority Dampier Port Limits
Distance from Operational Area to nearest marine park	• The trunkline corridor runs through the Montebello Marine Park – Multiple Use Zone (Cth), close to the northern boundary. • Offshore borrow ground located to the north of the Dampier Marine Park Habitat Protection Zone. A minimum 250 m buffer will be in place from the Marine Park boundaries.
Operational Areas	• **Scarborough Trunkline Project Area**: The proposed Trunkline from the Scarborough FPU (approximately 430 km north-west of the Burrup) to the State waters boundary and 1.5 km either side of the proposed Trunkline centreline to allow for the movement and positioning of vessels. This also includes Spoil Ground 5A, which is approximately 300 m wide and runs ~17 km from the State waters boundary.

- **Offshore Borrow Ground Project Area**: Offshore Borrow Ground (location where sand will be sourced). The Offshore Borrow Ground is approximately 17 km^2, located 20 km to the east of the proposed Trunkline route and adjacent to the Dampier Marine Park.

Relevant Fisheries	**Commonwealth:** North-West Slope Trawl Fishery **State:** Mackerel Managed Fishery (Area 2 and 3), Pilbara Crab Managed Fishery, Nickol Bay Prawn Managed Fishery, Pilbara Trawl Fishery, Pilbara Trap Fishery, Pilbara Line Fishery, Marine Aquarium Fishery and Specimen Shell Fishery.
*Additional Fisheries (*Consultation based on AFMA advice to consult all fisheries with entitlements to fish in the area)*	**Commonwealth:** Western Deepwater Trawl Fishery, Western Skipjack Fishery, Southern Bluefin Tuna Fishery, Western Tuna and Billfish Fishery
Relevant Commonwealth Fisheries	North-West Slope Trawl Fishery
*Additional Fisheries (*Consultation based on AFMA advice to consult all fisheries with entitlements to fish in the area)*	Western Deepwater Trawl Fishery, Western Skipjack Fishery, Southern Bluefin Tuna Fishery, Western Tuna and Billfish Fishery
Vessels:	• Trailing suction hopper dredge (TSHD) • Offshore construction vessel (OCV) • Fall pipe vessel (rock dump) • Primary Installation Vessel (PIV) multi-joint operation • Shallow Water Lay Barge (SWLB) • Anchor handling vessel/tug • Pipe supply vessels • Survey vessels • Support vessels • Fuel bunkering vessels

Potential risks to commercial fishing and proposed mitigation measures:

Potential Risk and/or Impact	Mitigation and/or Management Measure
Planned activities	
Interests of relevant stakeholders with respect to: • Defence activities • Petroleum activities • Commercial 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 EP. • Advice to relevant stakeholders prior to the commencement of activities. • All vessels within the Scarborough activity area will adhere to the navigation safety requirements including the Navigation Act 2012 and any subsequent Marine Orders.

Marine fauna interactions	• Vessel masters will implement interaction management actions in accordance with the EPBC Regulations 2000. • The dredging vessel will have trained crew as marine fauna observers and adhere to the observation and exclusion zones.
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	• Infrastructure will be positioned on the seabed within design footprint to reduce seabed disturbance. • Bathymetric and other surveys will be undertaken to monitor seabed characteristics before and after activities. • A management framework for dredging and backfill activities based on water quality will be developed. • Dredging and spoil disposal activities will be undertaken in compliance with a sea dumping permit. • A minimum 250 m buffer from the Dampier Marine Park boundaries will be in place for the borrow ground dredging activities.
Vessel interaction	• Woodside will notify relevant fishery stakeholders and government maritime safety agencies of specific start and end dates, specific vessel-on-location dates and any exclusion zones prior to commencement of the activity.
Waste management	• 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 accidental loss to the environment. • Wastes transported onshore will be sent to appropriate recycling or disposal facilities by a licensed waste contractor.
Unplanned activities	
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. • Contracted vessels comply with Australian ballast water requirements.

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 1800 442 977.

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 30 September 2021.
Regards

Graduate Corporate Affairs Adviser | Operations

1.20 Email sent to MAC (31 August 2021)

Dear [redacted]
Further to our brief discussion this morning on this matter, Woodside is planning to submit an Environment Plan (EP) to undertake seabed intervention and Trunkline installation activities in Commonwealth waters for the Scarborough development, in accordance with the Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2009 (Cth). Consultation regarding this matter forms part of the consultation between Woodside and MAC agreed in the 2 June 2021 letter. The information here is for your awareness.
A Consultation Information Sheet is attached, which provides background on the proposed activity, including a summary of potential key risk and associated management measures. It is also available on our website.

This EP falls under the primary environmental approval of the Scarborough Offshore Project Proposal (OPP) and will be conducted in line with relevant requirements of the OPP. The OPP includes a detailed description of activities and an assessment of impacts; with controls to develop acceptability criteria. It was accepted by NOPSEMA in March 2020 after an extensive public consultation process. Woodside is proposing four Commonwealth EPs for the Scarborough development to be submitted to NOPSEMA in the next two years, and will consult with all relevant stakeholders ahead of each EP.

A separate EP is planned to address Trunkline installation and seabed intervention activities in State waters, for approval by the Western Australian Department of Mines, Industry Regulation and Safety. The location of the proposed Trunkline in State waters is shown on the Consultation Information Sheet.
More information on the Scarborough development can be found here.

Activity:

Summary:	Seabed intervention and Trunkline installation activities in Commonwealth waters for the Scarborough development.
Location:	Activities run from the Commonwealth – State waters boundary approximately 32 km north of Dampier to the Scarborough gas field located at Woodside-operated title block WA-61-L, approximately 375 km west-northwest of the Burrup Peninsula.
Approx. Water Depth (m):	~ 32 m – 1400 m
Earliest commencement date:	Seabed intervention activities: Q4 2022 pending approvals, vessel availability and weather constraints Trunkline installation activities: Q4 2023 pending successful completion of State waters installation scope, approvals, vessel availability and weather constraints.
Estimated duration:	Approximately 24 months across multiple campaigns

Distance from Operational Area to nearest port/marina	Eastern end of the Trunkline route overlaps with the Pilbara Port Authority Dampier Port Limits
Distance from Operational Area to nearest marine park	• The trunkline corridor runs through the Montebello Marine Park – Multiple Use Zone (Cth), close to the northern boundary. • Offshore borrow ground located to the north of the Dampier Marine Park Habitat Protection Zone. A minimum 250 m buffer will be in place from the Marine Park boundaries.
Operational Areas	• **Scarborough Trunkline Project Area**: The proposed Trunkline from the Scarborough FPU (approximately 430 km north-west of the Burrup) to the State waters boundary and 1.5 km either side of the proposed Trunkline centreline to allow for the movement and positioning of vessels. This also includes Spoil Ground 5A, which is approximately 300 m wide and runs ~17 km from the State waters boundary. • **Offshore Borrow Ground Project Area**: Offshore Borrow Ground (location where sand will be sourced). The Offshore Borrow Ground is approximately 17 km^2, located 20 km to the east of the proposed Trunkline route and adjacent to the Dampier Marine Park.
Vessels:	• Trailing suction hopper dredge (TSHD) • Offshore construction vessel (OCV) • Fall pipe vessel (rock dump) • Primary Installation Vessel (PIV) multi-joint operation • Shallow Water Lay Barge (SWLB) • Anchor handling vessel/tug • Pipe supply vessels • Survey vessels • Support vessels • Fuel bunkering vessels

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 1800 442 977

Your feedback and our response will be included in our Environment Plan 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 30 September 2021.

Kind Regards,

Senior Corporate Affairs Adviser – Indigenous Affairs | Corporate Affairs

1.21 Email sent to NYFL (31 August 2021)

Dear [redacted]

Scarborough Seabed Intervention and Trunkline Installation Environment Plan

As discussed briefly over the phone, Woodside is planning to submit an Environment Plan (EP) to undertake seabed intervention and Trunkline installation activities in Commonwealth waters for the Scarborough development, in accordance with the Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2009 (Cth).
A Consultation Information Sheet is attached, which provides background on the proposed activity, including a summary of potential key risk and associated management measures. It is also available on our website.

This EP falls under the primary environmental approval of the Scarborough Offshore Project Proposal (OPP) and will be conducted in line with relevant requirements of the OPP. The OPP includes a detailed description of activities and an assessment of impacts; with controls to develop acceptability criteria. It was accepted by NOPSEMA in March 2020 after an extensive public consultation process. Woodside is proposing four Commonwealth EPs for the Scarborough development to be submitted to NOPSEMA in the next two years, and will consult with all relevant stakeholders ahead of each EP.

A separate EP is planned to address Trunkline installation and seabed intervention activities in State waters, for approval by the Western Australian Department of Mines, Industry Regulation and Safety. The location of the proposed Trunkline in State waters is shown on the Consultation Information Sheet.
More information on the Scarborough development can be found here.

Activity:

Summary:	Seabed intervention and Trunkline installation activities in Commonwealth waters for the Scarborough development.
Location:	Activities run from the Commonwealth – State waters boundary approximately 32 km north of Dampier to the Scarborough gas field located at Woodside-operated title block WA-61-L, approximately 375 km west-northwest of the Burrup Peninsula.
Approx. Water Depth (m):	~ 32 m – 1400 m
Earliest commencement date:	Seabed intervention activities: Q4 2022 pending approvals, vessel availability and weather constraints Trunkline installation activities: Q4 2023 pending successful completion of State waters installation scope, approvals, vessel availability and weather constraints.
Estimated duration:	Approximately 24 months across multiple campaigns
Distance from Operational Area to nearest port/marina	Eastern end of the Trunkline route overlaps with the Pilbara Port Authority Dampier Port Limits
Distance from Operational Area to nearest marine park	• The trunkline corridor runs through the Montebello Marine Park – Multiple Use Zone (Cth), close to the northern boundary. • Offshore borrow ground located to the north of the Dampier Marine Park Habitat Protection Zone. A minimum 250 m buffer will be in place from the Marine Park boundaries.
Operational Areas	• **Scarborough Trunkline Project Area**: The proposed Trunkline from the Scarborough FPU (approximately 430 km north-west of the Burrup) to the State waters boundary and 1.5 km either side of the proposed Trunkline centreline to allow for the movement and positioning of vessels. This also includes Spoil Ground 5A, which

is approximately 300 m wide and runs ~17 km from the State waters boundary.

- **Offshore Borrow Ground Project Area**: Offshore Borrow Ground (location where sand will be sourced). The Offshore Borrow Ground is approximately 17 km^2, located 20 km to the east of the proposed Trunkline route and adjacent to the Dampier Marine Park.

Vessels:

- Trailing suction hopper dredge (TSHD)
- Offshore construction vessel (OCV)
- Fall pipe vessel (rock dump)
- Primary Installation Vessel (PIV) multi-joint operation
- Shallow Water Lay Barge (SWLB)
- Anchor handling vessel/tug
- Pipe supply vessels
- Survey vessels
- Support vessels
- Fuel bunkering vessels

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 1800 442 977

Your feedback and our response will be included in our Environment Plan 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 30 September 2021.

Kind Regards,

Senior Corporate Affairs Adviser – Indigenous Affairs | Corporate Affairs

1.22 Email sent to Karratha Community Liaison Group (31 August 2021)

Dear Karratha Community Liaison Group members,

Woodside is planning to submit an Environment Plan (EP) to undertake seabed intervention and Trunkline installation activities in Commonwealth waters for the Scarborough development, in accordance with the Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2009 (Cth).

A Consultation Information Sheet is attached, which provides background on the proposed activity, including a summary of potential key risk and associated management measures. It is also available on our website.

This EP falls under the primary environmental approval of the Scarborough Offshore Project Proposal (OPP) and will be conducted in line with relevant requirements of the OPP. The OPP includes a detailed description of activities and an assessment of impacts; with controls to develop acceptability criteria. It was accepted by NOPSEMA in March 2020 after an extensive public consultation process. Woodside is proposing four Commonwealth EPs for the Scarborough development to be submitted to NOPSEMA in the next two years, and will consult with all relevant stakeholders ahead of each EP.

A separate EP is planned to address Trunkline installation and seabed intervention activities in State waters, for approval by the Western Australian Department of Mines, Industry Regulation and Safety. The location of the proposed Trunkline in State waters is shown on the Consultation Information Sheet.

More information on the Scarborough development can be found here.

Activity:

Summary:	Seabed intervention and Trunkline installation activities in Commonwealth waters for the Scarborough development.
Location:	Activities run from the Commonwealth – State waters boundary approximately 32 km north of Dampier to the Scarborough gas field located at Woodside-operated title block WA-61-L, approximately 375 km west-northwest of the Burrup Peninsula.
Approx. Water Depth (m):	~ 32 m – 1400 m
Earliest commencement date:	Seabed intervention activities: Q4 2022 pending approvals, vessel availability and weather constraints Trunkline installation activities: Q4 2023 pending successful completion of State waters installation scope, approvals, vessel availability and weather constraints.
Estimated duration:	Approximately 24 months across multiple campaigns
Distance from Operational Area to nearest port/marina	Eastern end of the Trunkline route overlaps with the Pilbara Port Authority Dampier Port Limits
Distance from Operational Area to nearest marine park	• The trunkline corridor runs through the Montebello Marine Park – Multiple Use Zone (Cth), close to the northern boundary. • Offshore borrow ground located to the north of the Dampier Marine Park Habitat Protection Zone. A minimum 250 m buffer will be in place from the Marine Park boundaries.
Operational Areas	• **Scarborough Trunkline Project Area**: The proposed Trunkline from the Scarborough FPU (approximately 430 km north-west of the Burrup) to the State waters boundary and 1.5 km either side of the proposed Trunkline centreline to allow for the movement and positioning of vessels. This also includes Spoil Ground 5A, which is approximately 300 m wide and runs ~17 km from the State waters boundary. • **Offshore Borrow Ground Project Area**: Offshore Borrow Ground (location where sand will be sourced). The Offshore Borrow Ground is approximately 17 km^2, located 20 km to the east of the proposed Trunkline route and adjacent to the Dampier Marine Park.
Vessels:	• Trailing suction hopper dredge (TSHD) • Offshore construction vessel (OCV) • Fall pipe vessel (rock dump) • Primary Installation Vessel (PIV) multi-joint operation • Shallow Water Lay Barge (SWLB)

- Anchor handling vessel/tug
- Pipe supply vessels
- Survey vessels
- Support vessels
- Fuel bunkering vessels

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 1800 442 977.

Your feedback and our response will be included in our Environment Plan 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 30 September 2021.

Best regards,

Corporate Affairs Adviser | Corporate Affairs Karratha

1.23 Email sent to KDCCI (31 August 2021)

Dear [redacted]

Woodside is planning to submit an Environment Plan (EP) to undertake seabed intervention and Trunkline installation activities in Commonwealth waters for the Scarborough development, in accordance with the Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2009 (Cth).

As part of this process, Woodside is consulting the Karratha and District Chamber of Commerce individually and as a member of the Karratha Community Liaison Group. A Consultation Information Sheet is attached, which provides background on the proposed activity, including a summary of potential key risk and associated management measures. It is also available on our website.

This EP falls under the primary environmental approval of the Scarborough Offshore Project Proposal (OPP) and will be conducted in line with relevant requirements of the OPP. The OPP includes a detailed description of activities and an assessment of impacts; with controls to develop acceptability criteria. It was accepted by NOPSEMA in March 2020 after an extensive public consultation process. Woodside is proposing four Commonwealth EPs for the Scarborough development to be submitted to NOPSEMA in the next two years, and will consult with all relevant stakeholders ahead of each EP.

A separate EP is planned to address Trunkline installation and seabed intervention activities in State waters, for approval by the Western Australian Department of Mines, Industry Regulation and Safety. The location of the proposed Trunkline in State waters is shown on the Consultation Information Sheet.

More information on the Scarborough development can be found here.

Activity:

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Location:	Activities run from the Commonwealth – State waters boundary approximately 32 km north of Dampier to the Scarborough gas field located at Woodside-operated title block WA-61-L, approximately 375 km west-northwest of the Burrup Peninsula.
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Earliest commencement date:	Seabed intervention activities: Q4 2022 pending approvals, vessel availability and weather constraints Trunkline installation activities: Q4 2023 pending successful completion of State waters installation scope, approvals, vessel availability and weather constraints.
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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 1800 442 977.

Your feedback and our response will be included in our Environment Plan 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 30 September 2021.

Best regards,

Corporate Affairs Adviser | Corporate Affairs Karratha

1.24 Email sent to City of Karratha (31 August 2021)

Dear [redacted] and [redacted]

Woodside is planning to submit an Environment Plan (EP) to undertake seabed intervention and Trunkline installation activities in Commonwealth waters for the Scarborough development, in accordance with the Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2009 (Cth).

As part of this process, Woodside is consulting the City of Karratha individually and as a member of the Karratha Community Liaison Group. A Consultation Information Sheet is attached, which provides background on the proposed activity, including a summary of potential key risk and associated management measures. It is also available on our website.

This EP falls under the primary environmental approval of the Scarborough Offshore Project Proposal (OPP) and will be conducted in line with relevant requirements of the OPP. The OPP includes a detailed description of activities and an assessment of impacts; with controls to develop acceptability criteria. It was accepted by NOPSEMA in March 2020 after an extensive public consultation process. Woodside is proposing four Commonwealth EPs for the Scarborough development to be submitted to NOPSEMA in the next two years, and will consult with all relevant stakeholders ahead of each EP.

A separate EP is planned to address Trunkline installation and seabed intervention activities in State waters, for approval by the Western Australian Department of Mines, Industry Regulation and Safety. The location of the proposed Trunkline in State waters is shown on the Consultation Information Sheet.

More information on the Scarborough development can be found here.

Activity:

Summary:	Seabed intervention and Trunkline installation activities in Commonwealth waters for the Scarborough development.
Location:	Activities run from the Commonwealth – State waters boundary approximately 32 km north of Dampier to the Scarborough gas field located at Woodside-operated title block WA-61-L, approximately 375 km west-northwest of the Burrup Peninsula.
Approx. Water Depth (m):	~ 32 m – 1400 m

Earliest commencement date:	Seabed intervention activities: Q4 2022 pending approvals, vessel availability and weather constraints Trunkline installation activities: Q4 2023 pending successful completion of State waters installation scope, approvals, vessel availability and weather constraints.
Estimated duration:	Approximately 24 months across multiple campaigns
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Distance from Operational Area to nearest marine park	• The trunkline corridor runs through the Montebello Marine Park – Multiple Use Zone (Cth), close to the northern boundary. • Offshore borrow ground located to the north of the Dampier Marine Park Habitat Protection Zone. A minimum 250 m buffer will be in place from the Marine Park boundaries.
Operational Areas	• **Scarborough Trunkline Project Area**: The proposed Trunkline from the Scarborough FPU (approximately 430 km north-west of the Burrup) to the State waters boundary and 1.5 km either side of the proposed Trunkline centreline to allow for the movement and positioning of vessels. This also includes Spoil Ground 5A, which is approximately 300 m wide and runs ~17 km from the State waters boundary. • **Offshore Borrow Ground Project Area**: Offshore Borrow Ground (location where sand will be sourced). The Offshore Borrow Ground is approximately 17 km^2, located 20 km to the east of the proposed Trunkline route and adjacent to the Dampier Marine Park.
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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 1800 442 977.

Your feedback and our response will be included in our Environment Plan 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 30 September 2021.

Best regards,

Corporate Affairs Adviser | Corporate Affairs Karratha

1.25 Email sent to CCWA (31 August 2021)

Dear [redacted]

Woodside is planning to submit an Environment Plan (EP) to undertake seabed intervention and trunkline installation activities in Commonwealth waters for the Scarborough development, in accordance with the Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2009 (Cth).

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.

An Environment Plan for this activity will be submitted in accordance with the *Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2009* (Cth).

If you have any comments about these activities in this location then please respond to Woodside at Feedback@woodside.com.au or 1800 442 977.

Your feedback and our response will be included in our Environment Plans, 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).

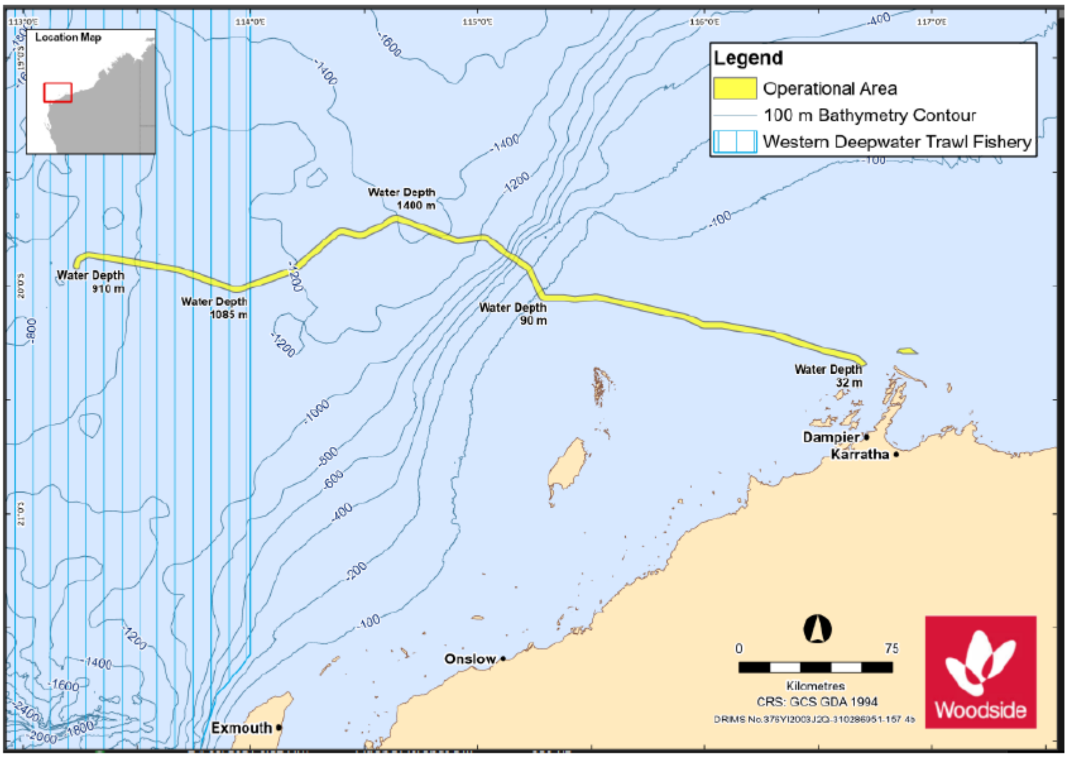
Please let us know if your feedback for this activity is sensitive and we will make this known to NOPSEMA upon submission of the Environment Plan in order for this information to remain confidential to NOPSEMA.

Please provide your feedback by 30 September 2021.

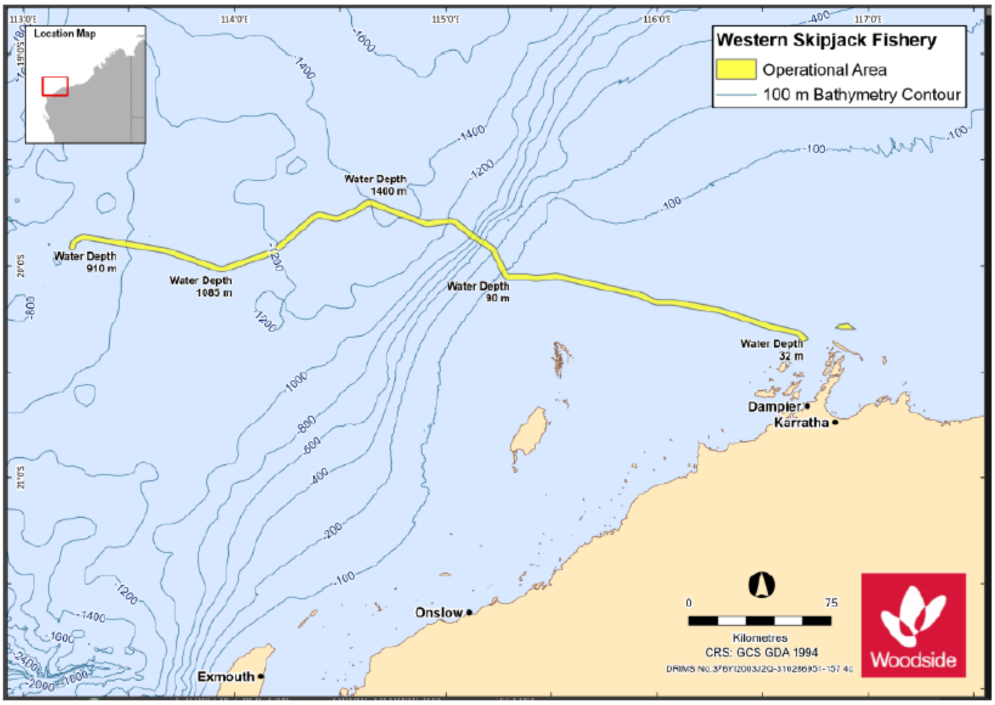
Woodside Feedback

1.26 Commonwealth Fisheries map sent to DAWE, WAFIC, DPIRD, PPA, AFMA, CFA, Commonwealth fisheries licence holders (North West Slope Trawl Fishery, Western Deepwater Trawl, Western Skipjack, Northern Prawn, Western Tuna and Billfish, Southern Bluefin Tuna), Southern Bluefin Tuna Industry Association (31 August 2021)

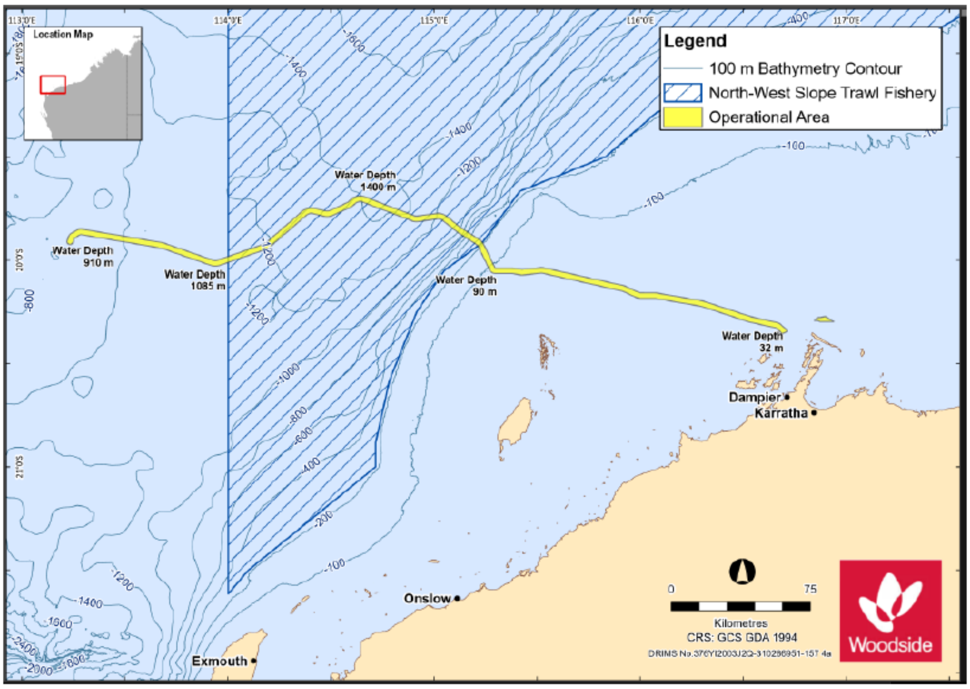
Western Deepwater Trawl Fishery



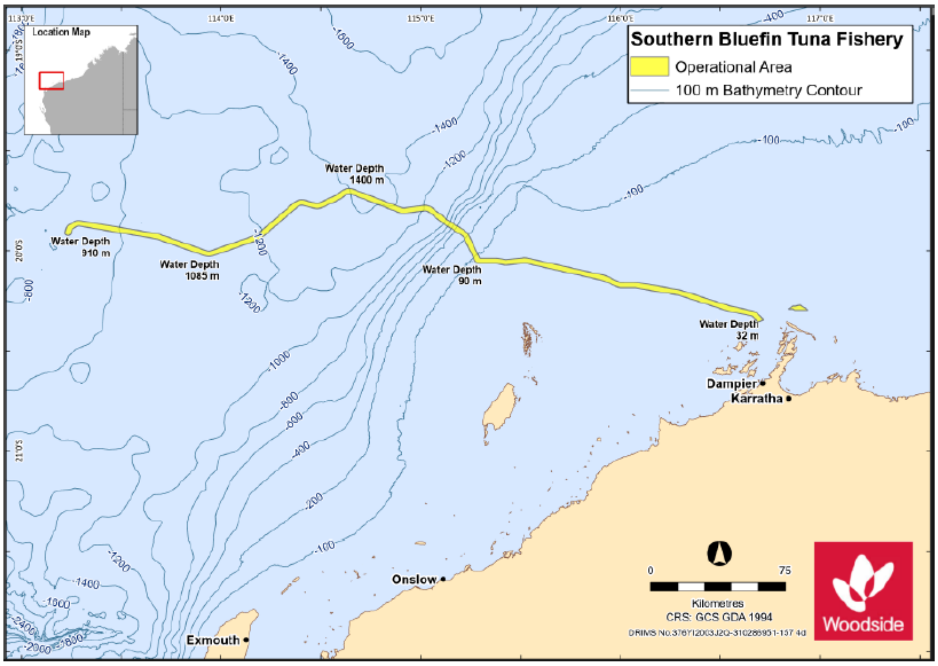
Western Skipjack Fishery



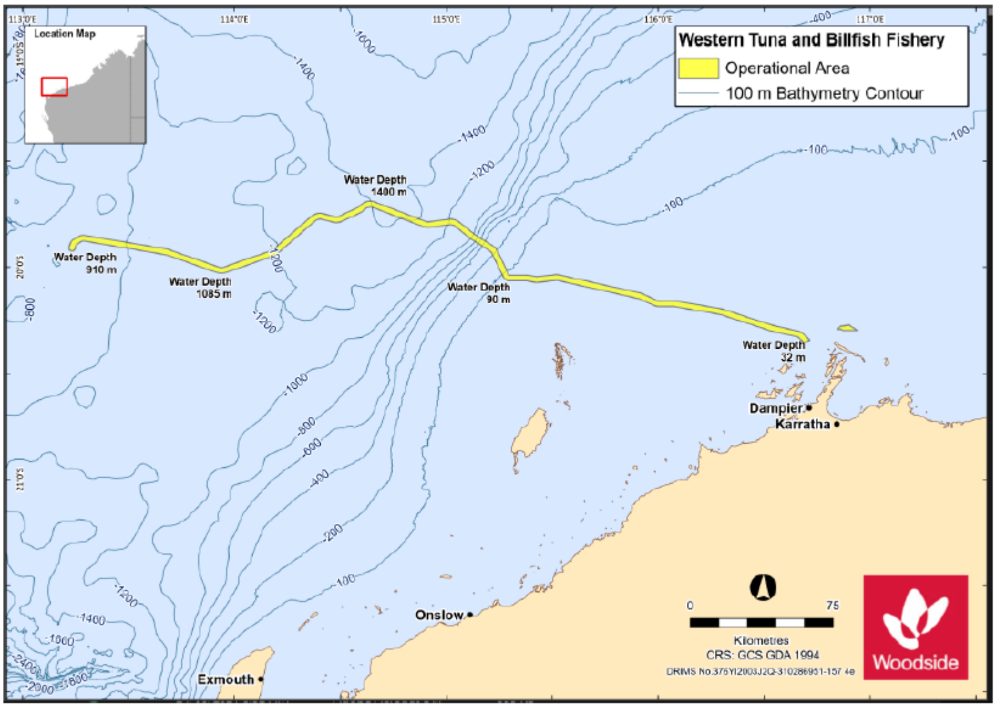
North-West Slope Trawl Fishery



Southern Bluefin Tuna Fishery

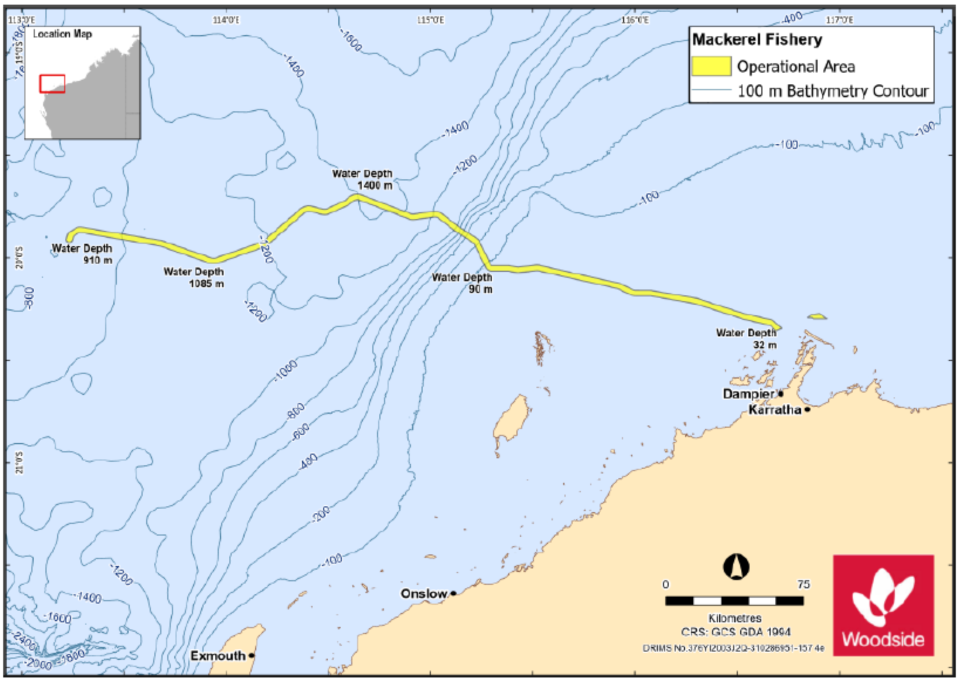


Western Tuna and Billfish Fishery

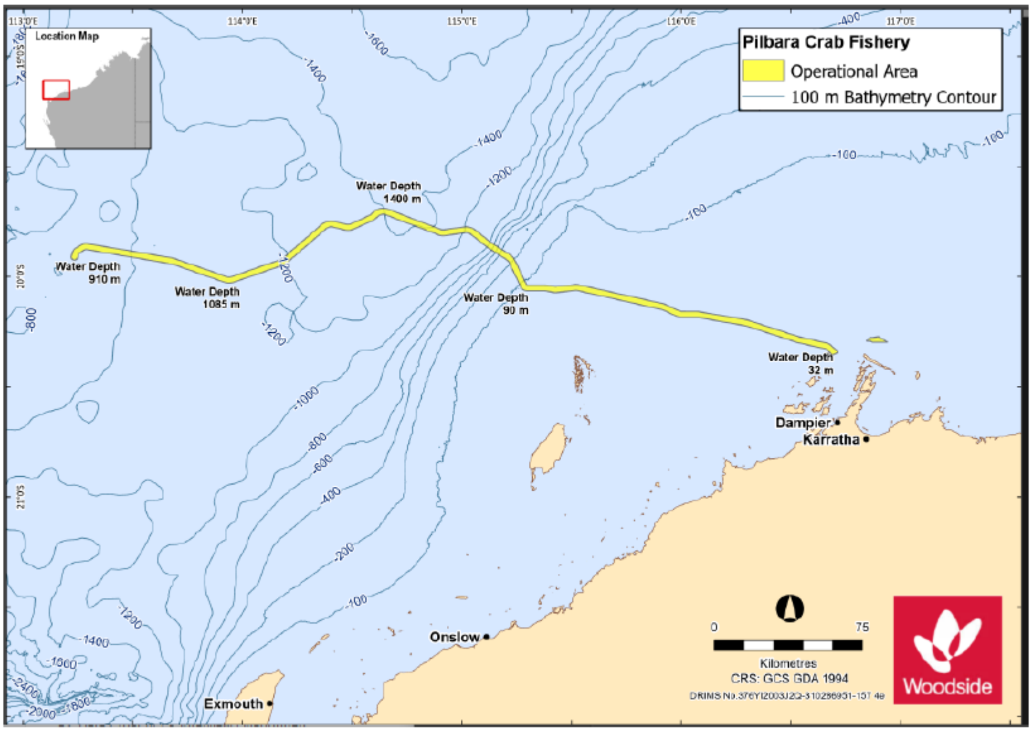


1.27 State Fisheries map sent to, WAFIC, State fisheries licence holders (Pilbara Trap, Pilbara Trawl, Pilbara Line), DPIRD, AFMA, CFA, PPA, Southern Bluefin Tuna Industry Association (31 August 2021)

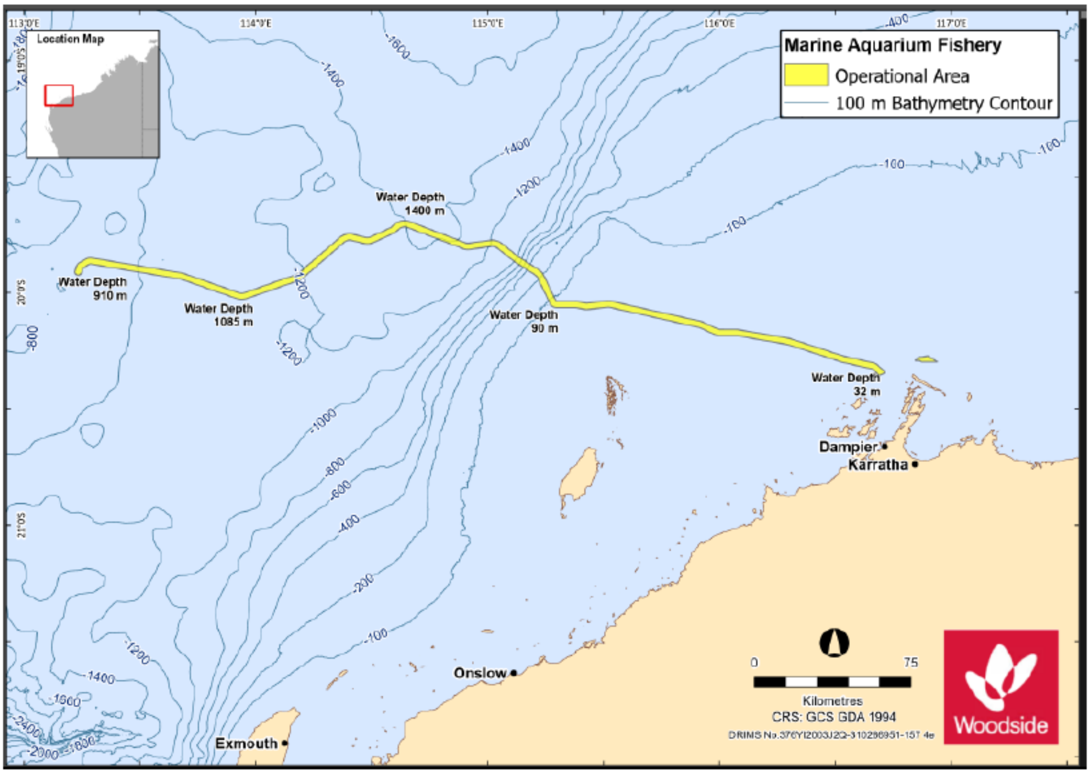
Mackerel Managed Fishery (Areas 2 and 3)



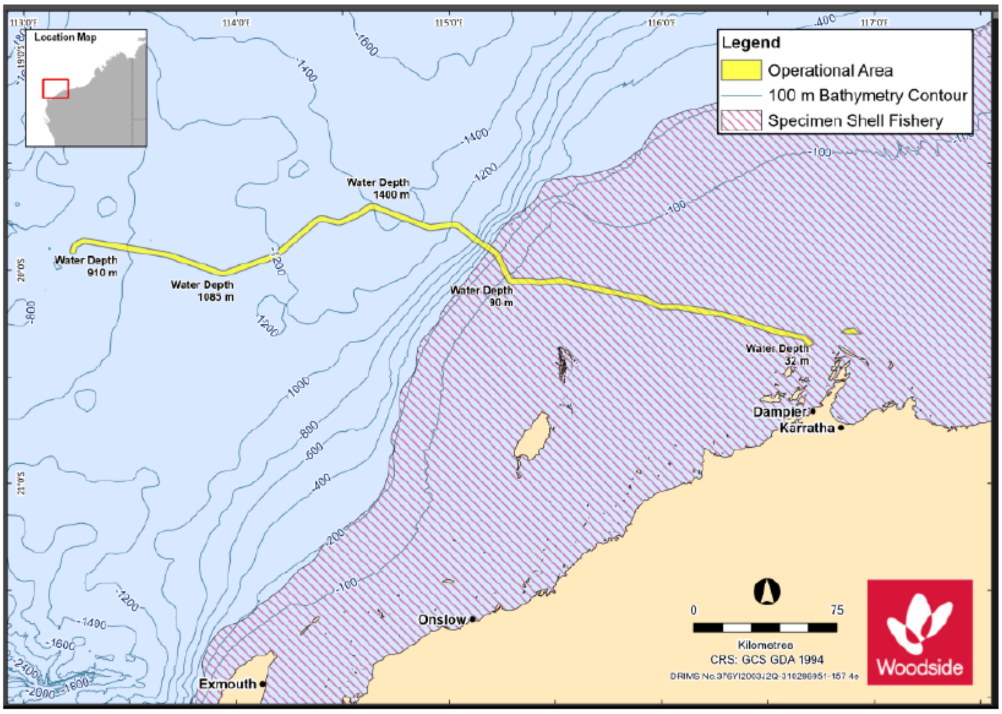
Pilbara Crab Fishery



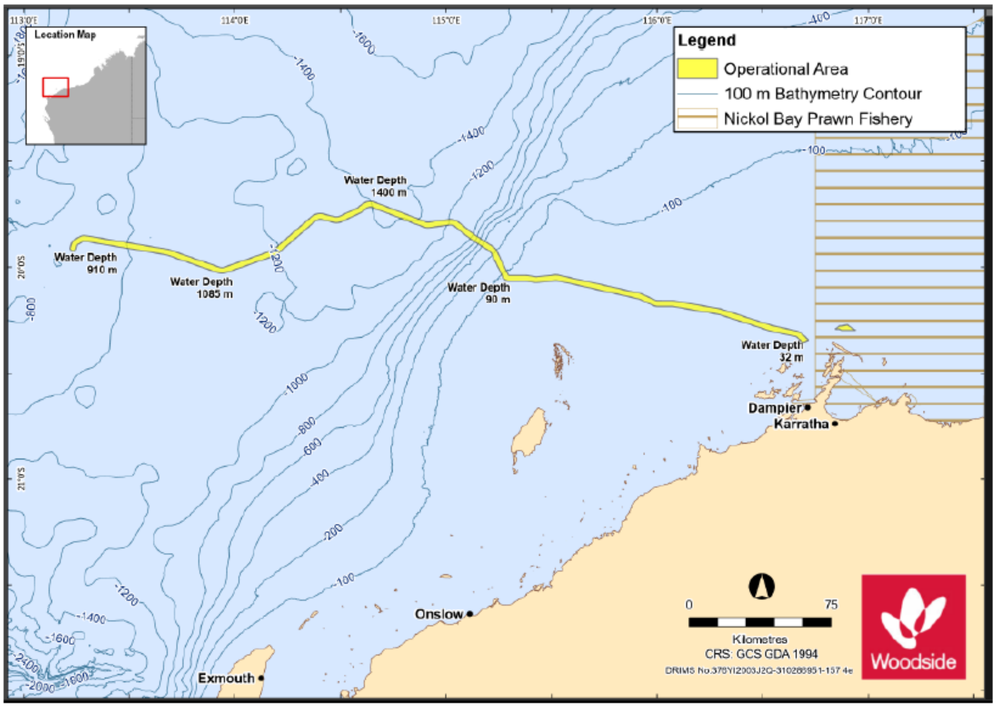
Marine Aquarium Managed Fishery



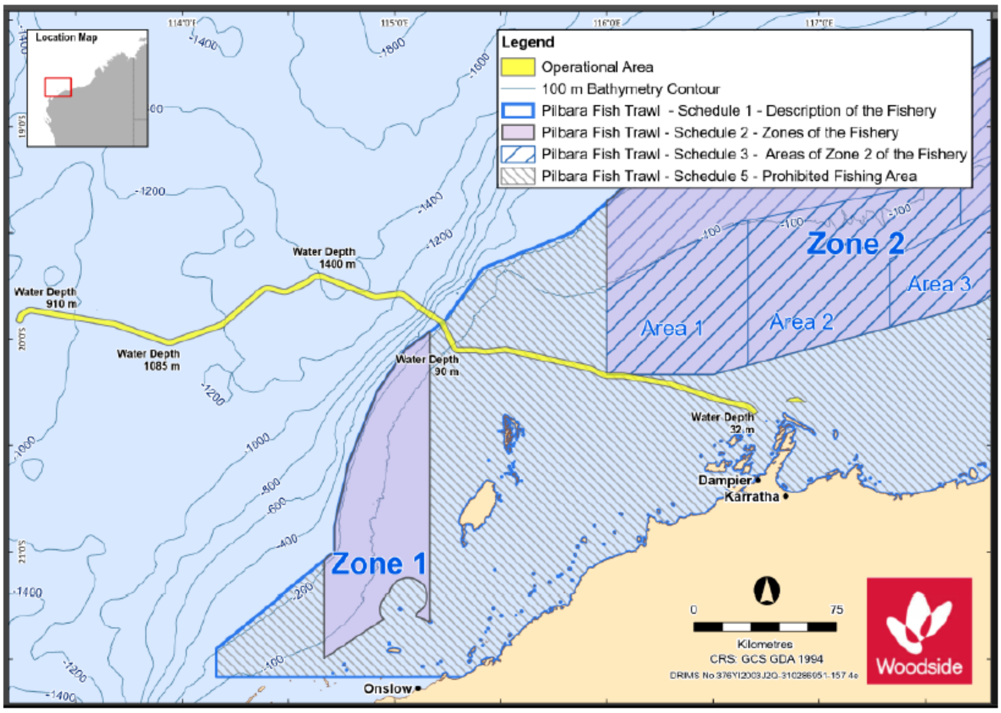
Specimen Shell Fishery



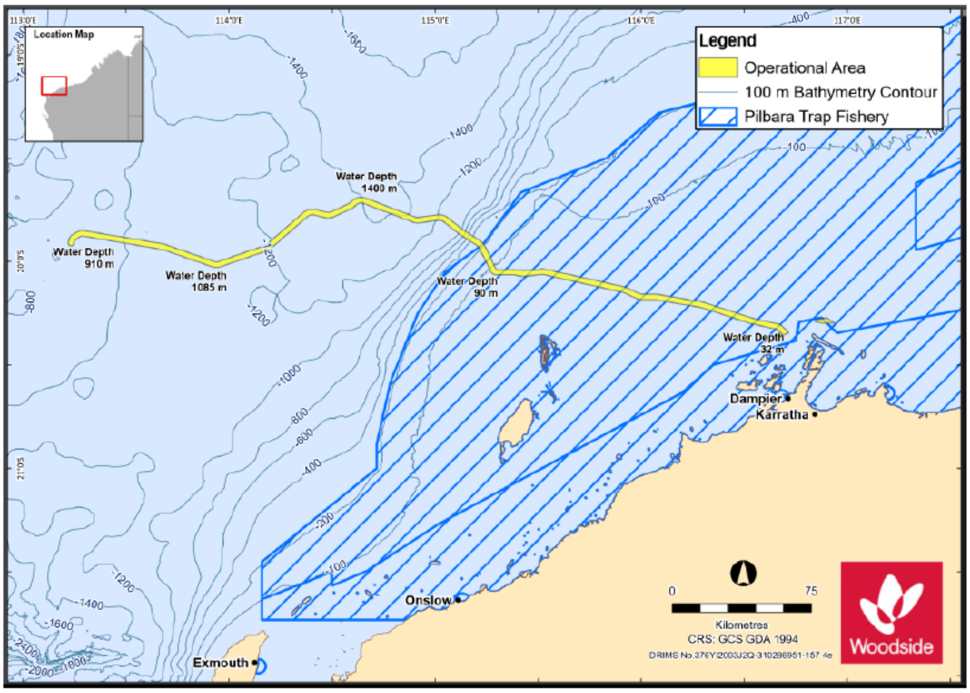
Nickol Bay Prawn Managed Fishery



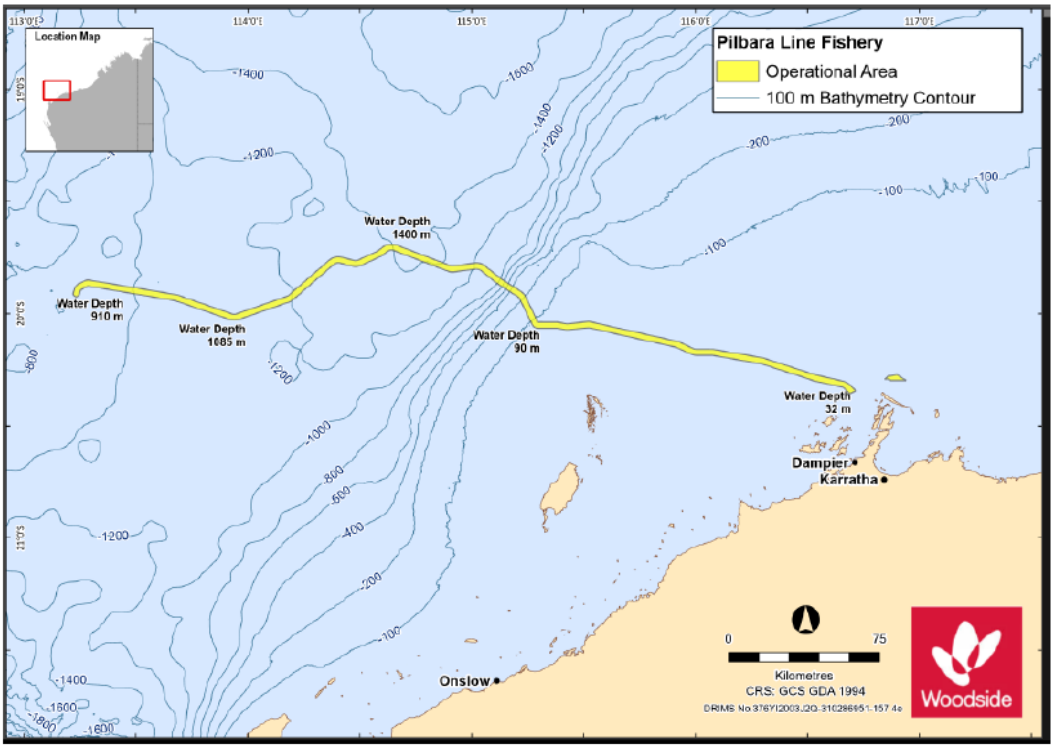
Pilbara Trawl Fishery



Pilbara Trap Fishery

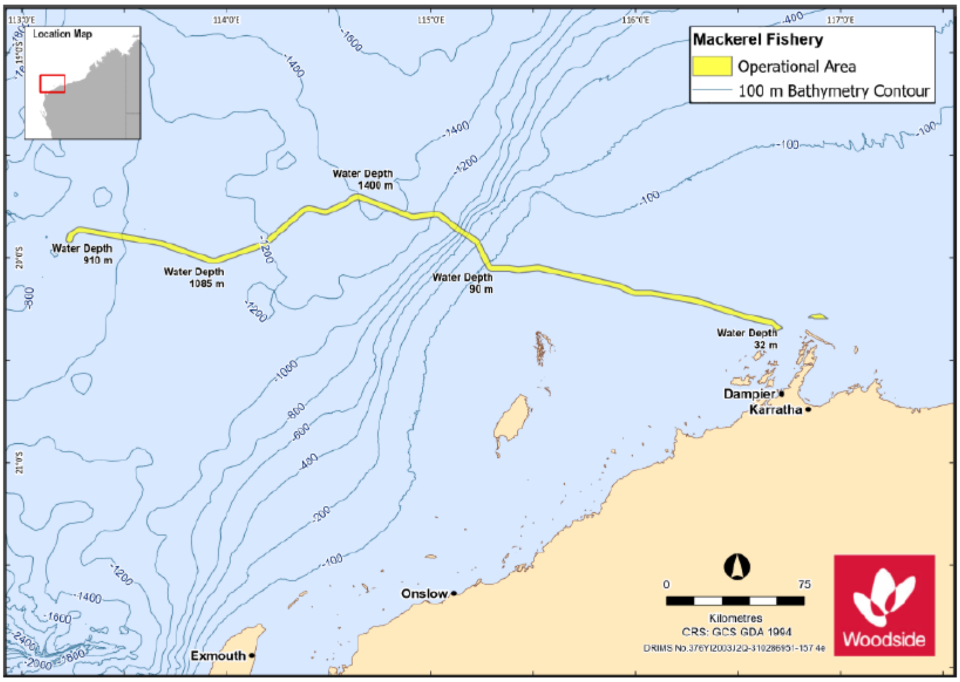


Pilbara Line Fishery



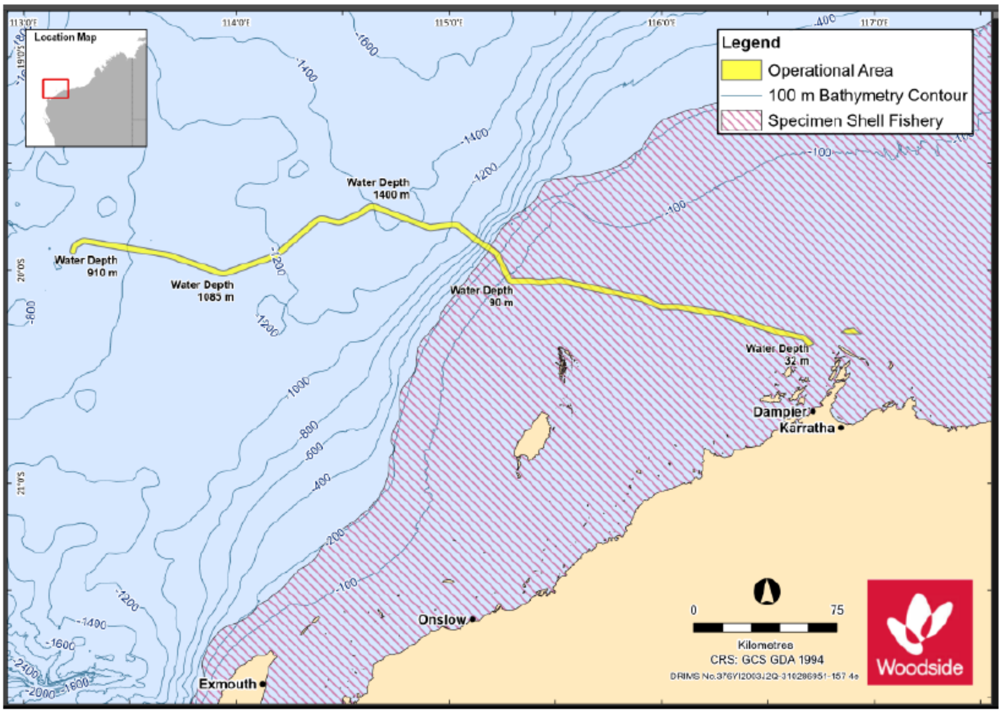
1.28 Map sent to licence holders (Mackerel Areas 2 and 3) (1 September 2021)

Mackerel Managed Fishery (Areas 2 and 3)



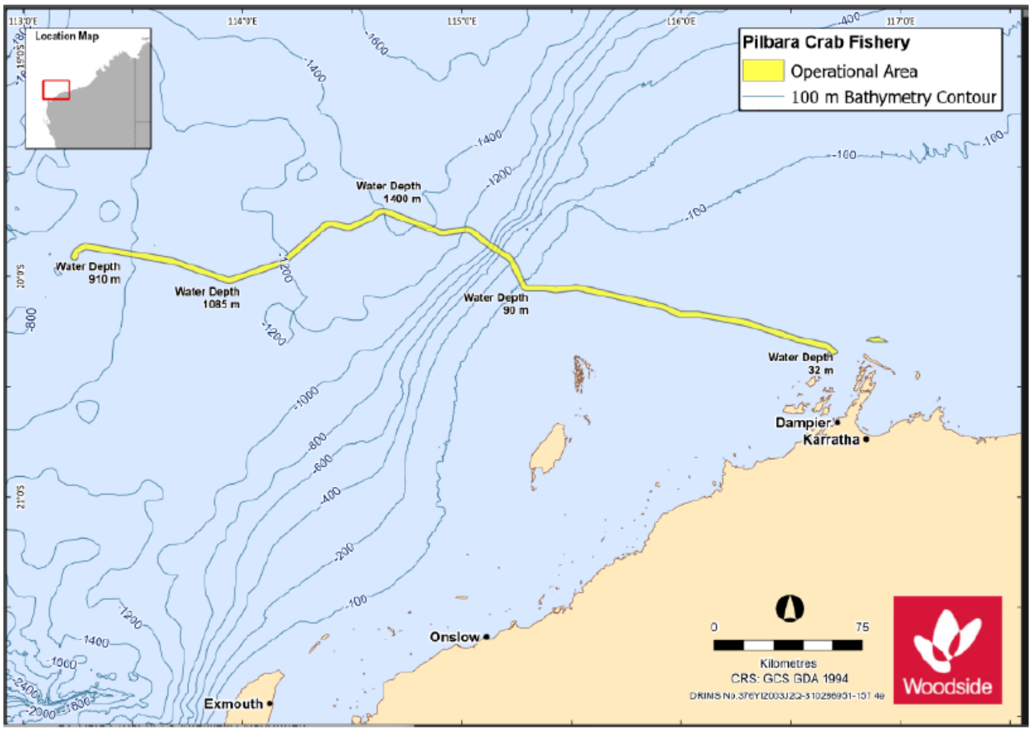
1.29 Map sent to licence holders (Specimen Shell) (1 September 2021)

Specimen Shell Fishery



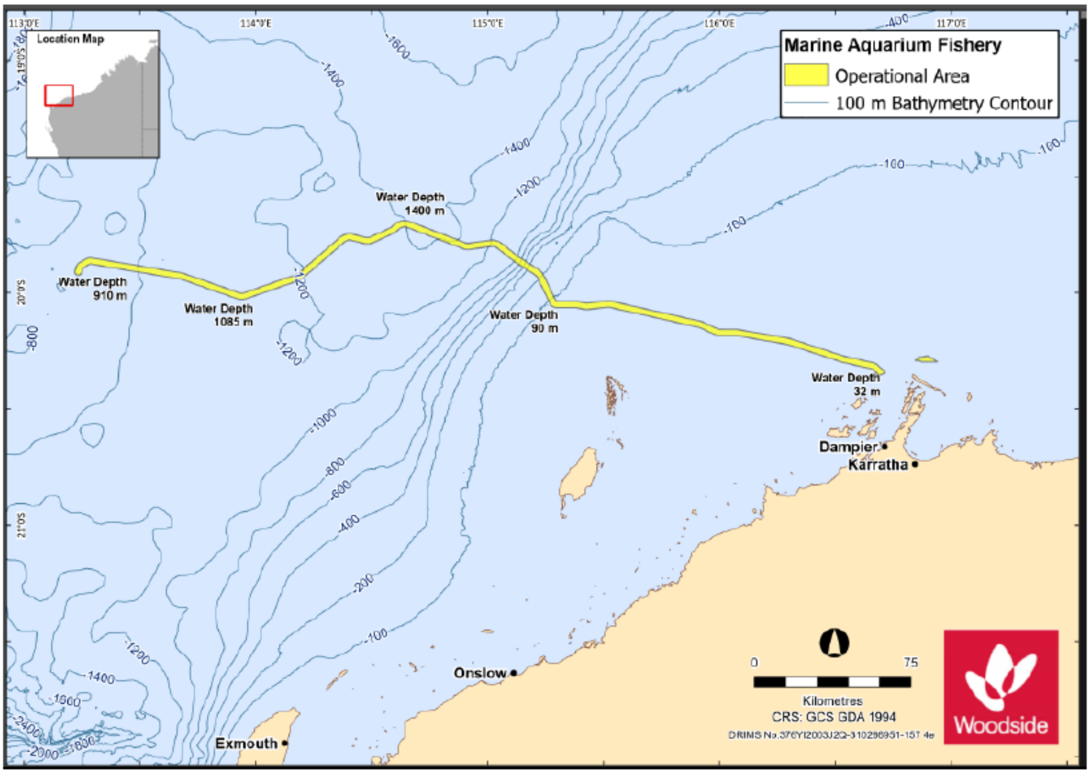
1.30 Map sent to licence holders (Pilbara Crab) (1 September 2021)

Pilbara Crab Fishery



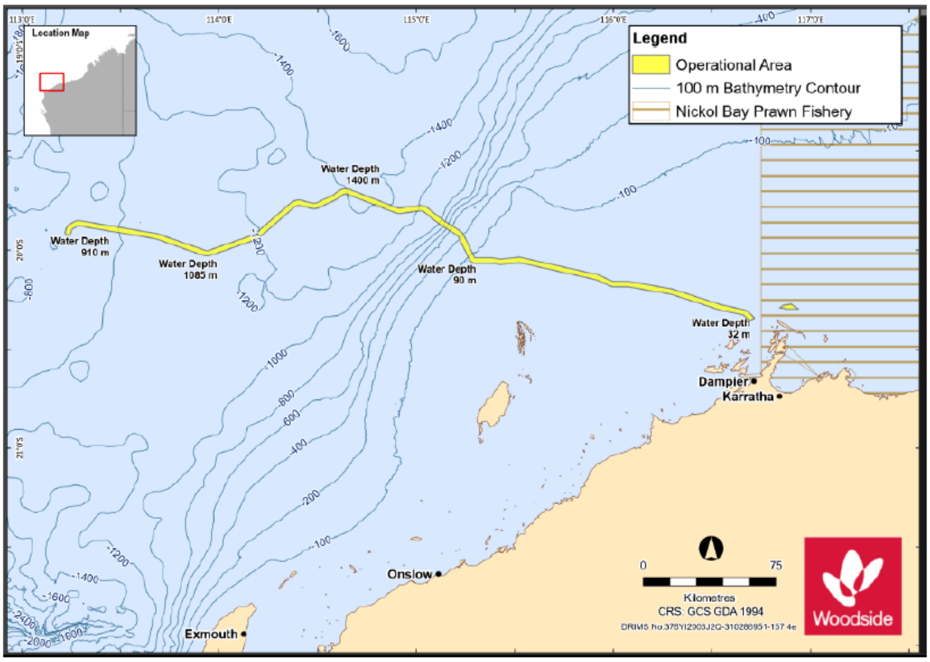
1.31 Map sent to licence holders (Marine Aquarium) (1 September 2021)

Marine Aquarium Managed Fishery



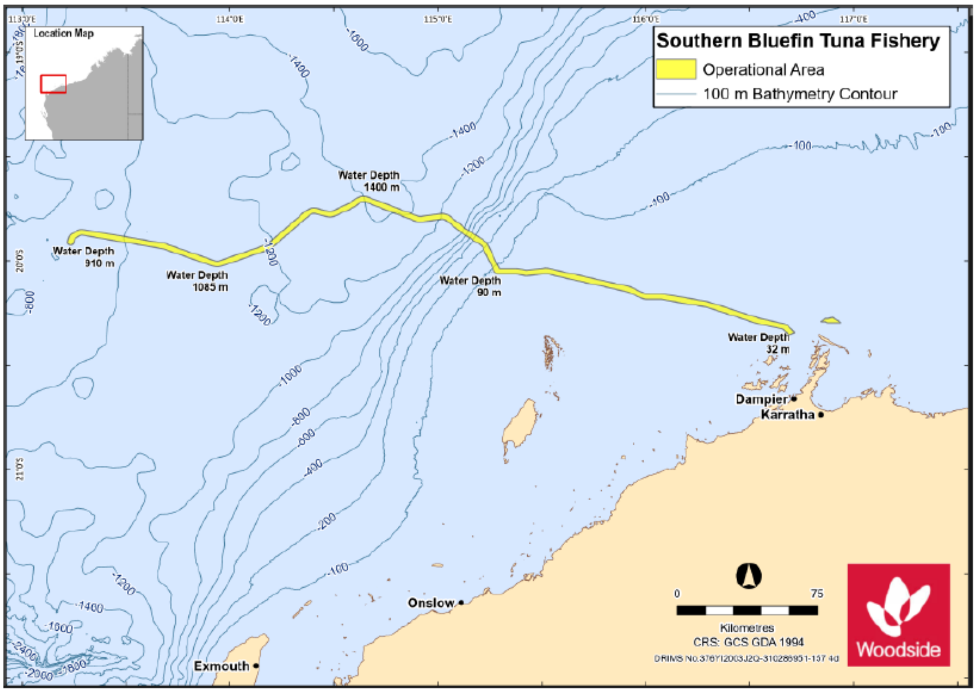
1.32 Map sent to licence holders (Nickol Bay Prawn) (1 September 2021)

Nickol Bay Prawn Managed Fishery



1.33 Map sent to licence holders (Southern Bluefin Tuna) (1 September 2021)

Southern Bluefin Tuna Fishery



1.34 Oil Pollution First Strike Plan emailed to AMSA (5 November 2021)

Dear [redacted]

As part of Woodside's ongoing consultation for its current and planned activities, I would like to advise the Australian Maritime Safety Authority (AMSA) that Woodside is preparing the *Scarborough Subsea Intervention and Trunkline Installation Environment Plan* to undertake seabed intervention and trunkline installation activities in Commonwealth waters for the proposed Scarborough development and would like to offer AMSA the opportunity to provide feedback on the First Strike Plan.

Information is presented as follows:

- A Consultation Information Sheet providing information on the proposed activities is available on Woodside's website here.
- The *Scarborough Subsea Infrastructure and Trunkline Installation 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 in December 2021. Should you require additional information or have a comment to make about the First Strike Plan, please contact me by close of business 6 December to allow us sufficient time to inform our activity planning and EP development.

Feedback can be submitted via email or letter to: feedback@woodside.com.au or by phone at [redacted].

Your feedback and our response will be included in our Environment Plan 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.

We look forward to hearing from you.

Many thanks,

Hydrocarbon Spill Coordinator | Security & Emergency Management

1.35 Oil Pollution First Strike Plan emailed to DoT (5 November 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 is preparing the Scarborough Subsea Intervention and Trunkline Installation Environment Plan to undertake seabed intervention and trunkline installation activities in Commonwealth waters for the proposed Scarborough development and would like to offer DoT the opportunity to provide feedback on the First Strike Plan.

Information is presented as follows:

A Consultation Information Sheet providing information on the proposed activities is available on Woodside's website here.

The Scarborough Subsea Intervention and Trunkline Installation 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).

A summary of activity-specific information in response to DoT's consultation expectations, as per its Offshore Petroleum Industry Guidance Note (July 2020), is included in the table below.

Woodside propose to submit an EP in December 2021.   Should you require additional information or have a comment to make about the First Strike Plan, please contact me by close of business 6 December to allow us sufficient time to inform our activity planning and EP development.

Feedback can be submitted via email or letter to: feedback@woodside.com.au or by phone at [redacted]

Your feedback and our response will be included in our Environment Plan 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.

We look forward to hearing from you.

Many thanks,

Information Requested in the Offshore Petroleum Industry Guidance Note (July 2020)	**Information Provided & Reference**
Description of activity, including the intended schedule, location (including coordinates), distance to nearest landfall and map.	Included in the consultation information sheet
Worst case spill volumes.	Included in Appendix A of the First Strike Plan
Known or indicative oil type/properties.	Included in Appendix A of the First Strike Plan
Amenability of oil to dispersants and window of opportunity for dispersant efficacy.	Dispersant is not deemed to be suitable for marine diesel spill.
Description of existing environment and protection priorities.	Included in section 4 of the First Strike Plan
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).	Unplanned loss of containment events from the Petroleum Activities Program have been identified during the risk assessment process (presented in 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. Three 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. One worst-case credible scenario (CS-01) has been used for response planning purposes for the activity 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.
	Credible Scenario-01: a short-term (instantaneous) surface release of 2,000 m^3 of

Outcomes of oil spill trajectory modelling, including predicted times to enter State waters and contact shorelines.		marine diesel from a vessel collision outside Mermaid Sound – residue of 100 m^3 (5%) Minimum time to shoreline contact (above 100 g/m^2) in days
	Dampier Archipelago	53 hours (2.2 days) – 3 m^3
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.	• Level 1 Response – one Level 1 'First Strike' drill conducted within two weeks of commencing activity and then at least every 6 month hire period thereafter. • Level 2 Response – a minimum of one Emergency Management exercise conducted within one month of commencing activity and then at least every 6 month hire period thereafter. • Level 3 Response – 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. **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'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.

Hydrocarbon Spill Coordinator | Security & Emergency Management

1.36 Oil Pollution First Strike Plan emailed to Pilbara Ports Authority (5 November 2021)

Dear [redacted]

As part of Woodside's ongoing consultation for its current and planned activities, and as agreed during a recent meeting between the Woodside Scarborough Project Team and Pilbara Ports Authority (PPA),I would like to advise PPA that Woodside is preparing the *Scarborough Subsea Intervention and Trunkline Installation Environment Plan* to undertake seabed intervention and trunkline installation activities in Commonwealth waters for the proposed Scarborough development and would like to offer PPA the opportunity to provide feedback on the First Strike Plan.

Information is presented as follows:

- A Consultation Information Sheet providing information on the proposed activities is available on Woodside's website here.
- The *Scarborough Subsea Infrastructure and Trunkline Installation 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 in December 2021. Should you require additional information or have a comment to make about the First Strike Plan, please contact me by close of business 6 December to allow us sufficient time to inform our activity planning and EP development.

Feedback can be submitted via email or letter to: feedback@woodside.com.au or by phone at [redacted]

Your feedback and our response will be included in our Environment Plan 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.

We look forward to hearing from you.

Many thanks,

Hydrocarbon Spill Coordinator | Security & Emergency Management

APPENDIX G. DEPARTMENT OF ABORIGINAL AFFAIRS HERITAGE SEARCH RESULTS

Aboriginal Heritage Inquiry System

List of Other Heritage Places

Search Criteria

40 Other Heritage Places in Shapefile - EMBA_20210901. Warning: Search area complex so results may be inaccurate. Contact DPLH for assistance.

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

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.

ID	Name	File Restricted	Boundary Restricted	Restrictions	Status	Type	Knowledge Holders	Coordinate	Legacy ID
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
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

ID	Name	File Restricted	Boundary Restricted	Restrictions	Status	Type	Knowledge Holders	Coordinate	Legacy ID
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
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
7208	MILYERING ROCKS.	No	No	No Gender Restrictions	Lodged	Hunting Place	*Registered Knowledge Holder names available from DAA	800842mE 7560649mN Zone 49 [Reliable]	P05712
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
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
20621	Bedout Island	No	No	No Gender Restrictions	Lodged	Mythological, Natural Feature, Other: Island	*Registered Knowledge Holder names available from DAA	720197mE 7832653mN Zone 50 [Reliable]	
22943	Flacourt Bay 01	No	No	No Gender Restrictions	Lodged	Rockshelter	*Registered Knowledge Holder names available from DAA	331540mE 7705613mN 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]	
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]	
36199	Boodie Cave	No	No		Lodged	Artefacts / Scatter, Rockshelter	*Registered Knowledge Holder names available from DAA	329709mE 7703887mN Zone 50 [Reliable]	

ID	Name	File Restricted	Boundary Restricted	Restrictions	Status	Type	Knowledge Holders	Coordinate	Legacy ID
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]	
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]	

Aboriginal Heritage Inquiry System

List of Other Heritage Places

ID	Name	File Restricted	Boundary Restricted	Restrictions	Status	Type	Knowledge Holders	Coordinate	Legacy ID
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]	
38763	Wapet Shell Midden	No	No		Stored Data / Not a Site	Shell	*Registered Knowledge Holder names available from DAA	340812mE 7707336mN Zone 50 [Reliable]	

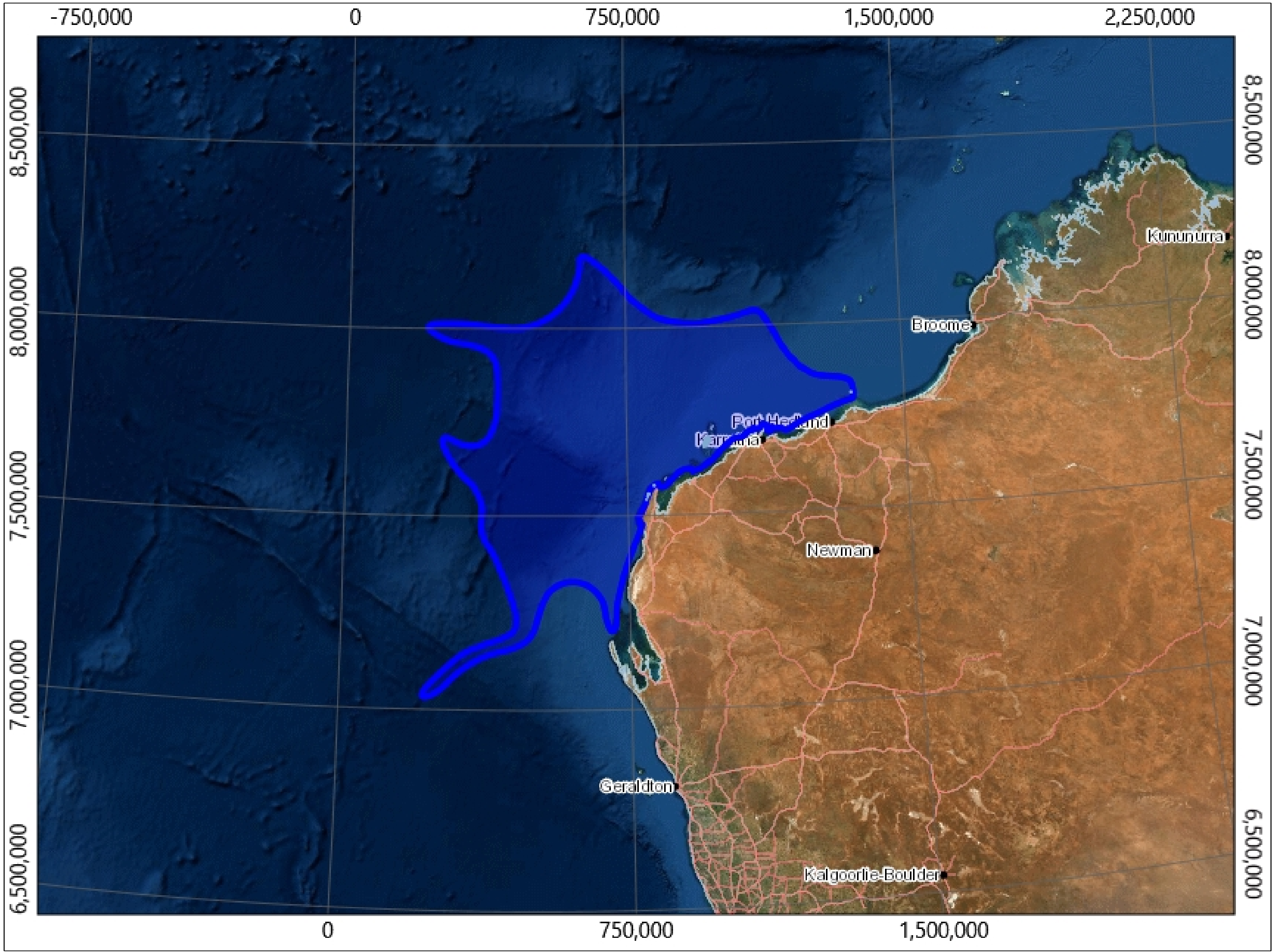
Department of Planning, Lands and Heritage

GOVERNMENT OF WESTERN AUSTRALIA

Aboriginal Heritage Inquiry System

Map of Other Heritage Places

For further important information on using this information please see the Department of Planning, Lands and Heritage's Disclaimer statement at https://www.dplh.wa.gov.au/about-this-website



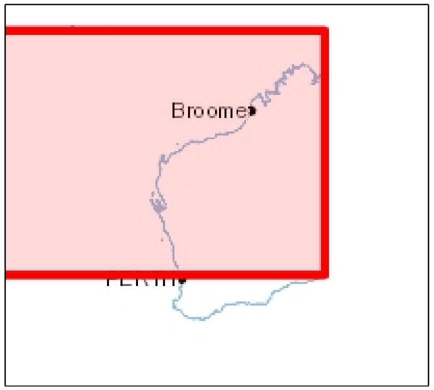
Legend

- Other Heritage Place
- Search Area
- Town
- Road
- River
- Local Government Authority

546.06 kilometres

Map Scale 1 : 16,550,000

MGA Zone 49 (GDA94)



Aboriginal Heritage Inquiry System

List of Registered Aboriginal Sites

Search Criteria

54 Registered Aboriginal Sites in Shapefile - EMBA_20210901. Warning: Search area complex so results may be inaccurate. Contact DPLH for assistance.

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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Copyright

Coordinate Accuracy

Coordinates (Easting/Northing metres) are based on the GDA 94 Datum. Accuracy is shown as a code in brackets following the coordinates.

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 $4km^2$) 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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Aboriginal Heritage Inquiry System

List of Registered Aboriginal Sites

ID	Name	File Restricted	Boundary Restricted	Restrictions	Status	Type	Knowledge Holders	Coordinate	Legacy ID
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
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
966	ROSEMARY IS.11: CHOOKIE BAY	No	No	No Gender Restrictions	Registered Site	Artefacts / Scatter, Midden / Scatter	*Registered Knowledge Holder names available from DAA	459339mE 7736355mN Zone 50 [Unreliable]	P07219
967	ROSEMARY IS.12: CHOOKIE BAY	No	No	No Gender Restrictions	Registered Site	Artefacts / Scatter, Quarry	*Registered Knowledge Holder names available from DAA	458839mE 7736655mN Zone 50 [Unreliable]	P07220
968	ROSEMARY IS.13	No	No	No Gender Restrictions	Registered Site	Artefacts / Scatter, Grinding Patches / Grooves, Midden / Scatter	*Registered Knowledge Holder names available from DAA	458839mE 7736955mN Zone 50 [Unreliable]	P07221
969	ROSEMARY IS.14	No	No	No Gender Restrictions	Registered Site	Artefacts / Scatter, Grinding Patches / Grooves, Midden / Scatter	*Registered Knowledge Holder names available from DAA	458939mE 7736855mN Zone 50 [Unreliable]	P07222
970	ROSEMARY IS.15: AIRSTRIP	No	No	No Gender Restrictions	Registered Site	Artefacts / Scatter, Grinding Patches / Grooves, Midden / Scatter	*Registered Knowledge Holder names available from DAA	458739mE 7737855mN Zone 50 [Unreliable]	P07223
971	ROSEMARY IS.16: AIRSTRIP	No	No	No Gender Restrictions	Registered Site	Artefacts / Scatter, Midden / Scatter, Quarry	*Registered Knowledge Holder names available from DAA	458539mE 7737855mN Zone 50 [Unreliable]	P07224
972	ROSEMARY IS.17: AIRSTRIP	No	No	No Gender Restrictions	Registered Site	Artefacts / Scatter, Quarry	*Registered Knowledge Holder names available from DAA	458139mE 7737655mN Zone 50 [Unreliable]	P07225

ID	Name	File Restricted	Boundary Restricted	Restrictions	Status	Type	Knowledge Holders	Coordinate	Legacy ID
973	ROSEMARY IS.18: DEEP WATER	No	No	No Gender Restrictions	Registered Site	Artefacts / Scatter, Midden / Scatter	*Registered Knowledge Holder names available from DAA	457039mE 7736655mN Zone 50 [Unreliable]	P07226
974	ROSEMARY IS.19: CHITON	No	No	No Gender Restrictions	Registered Site	Artefacts / Scatter, Midden / Scatter	*Registered Knowledge Holder names available from DAA	456839mE 7736355mN Zone 50 [Unreliable]	P07227
978	ROSEMARY IS.23: WADJURU R/H	No	No	No Gender Restrictions	Registered Site	Artefacts / Scatter, Engraving, Grinding Patches / Grooves, Man-Made Structure, Midden / Scatter, Water Source	*Registered Knowledge Holder names available from DAA	455839mE 7734355mN Zone 50 [Unreliable]	P07231
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
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
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
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

ID	Name	File Restricted	Boundary Restricted	Restrictions	Status	Type	Knowledge Holders	Coordinate	Legacy ID
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
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
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
7124	DORRE ISLAND	No	No	No Gender Restrictions	Registered Site	Skeletal Material / Burial	*Registered Knowledge Holder names available from DAA	711750mE 7220260mN Zone 49 [Unreliable]	P05790
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
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
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
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
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
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
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

ID	Name	File Restricted	Boundary Restricted	Restrictions	Status	Type	Knowledge Holders	Coordinate	Legacy ID
11328	GAP WELL	No	No	No Gender Restrictions	Registered Site	Engraving	*Registered Knowledge Holder names available from DAA	458639mE 7736755mN Zone 50 [Unreliable]	P00836
11458	NINGALOO (near)	No	No	No Gender Restrictions	Registered Site	Painting	*Registered Knowledge Holder names available from DAA	781642mE 7511649mN Zone 49 [Unreliable]	P00701
11775	ROSEMARY ISLAND 06	No	No	No Gender Restrictions	Registered Site	Engraving	*Registered Knowledge Holder names available from DAA	457839mE 7737256mN Zone 50 [Unreliable]	P00372
11789	ROSEMARY ISLAND 01	No	No	No Gender Restrictions	Registered Site	Artefacts / Scatter, Engraving, Midden / Scatter, Quarry	*Registered Knowledge Holder names available from DAA	458889mE 7737155mN Zone 50 [Unreliable]	P00386
11820	ENDERBY ISLAND 01	No	No	No Gender Restrictions	Registered Site	Engraving	*Registered Knowledge Holder names available from DAA	445137mE 7725156mN Zone 50 [Unreliable]	P00364
17193	Ningaloo Station	No	No	No Gender Restrictions	Registered Site	Skeletal Material / Burial	*Registered Knowledge Holder names available from DAA	775891mE 7489149mN Zone 49 [Unreliable]	

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GOVERNMENT OF WESTERN AUSTRALIA

Aboriginal Heritage Inquiry System

Map of Registered Aboriginal Sites

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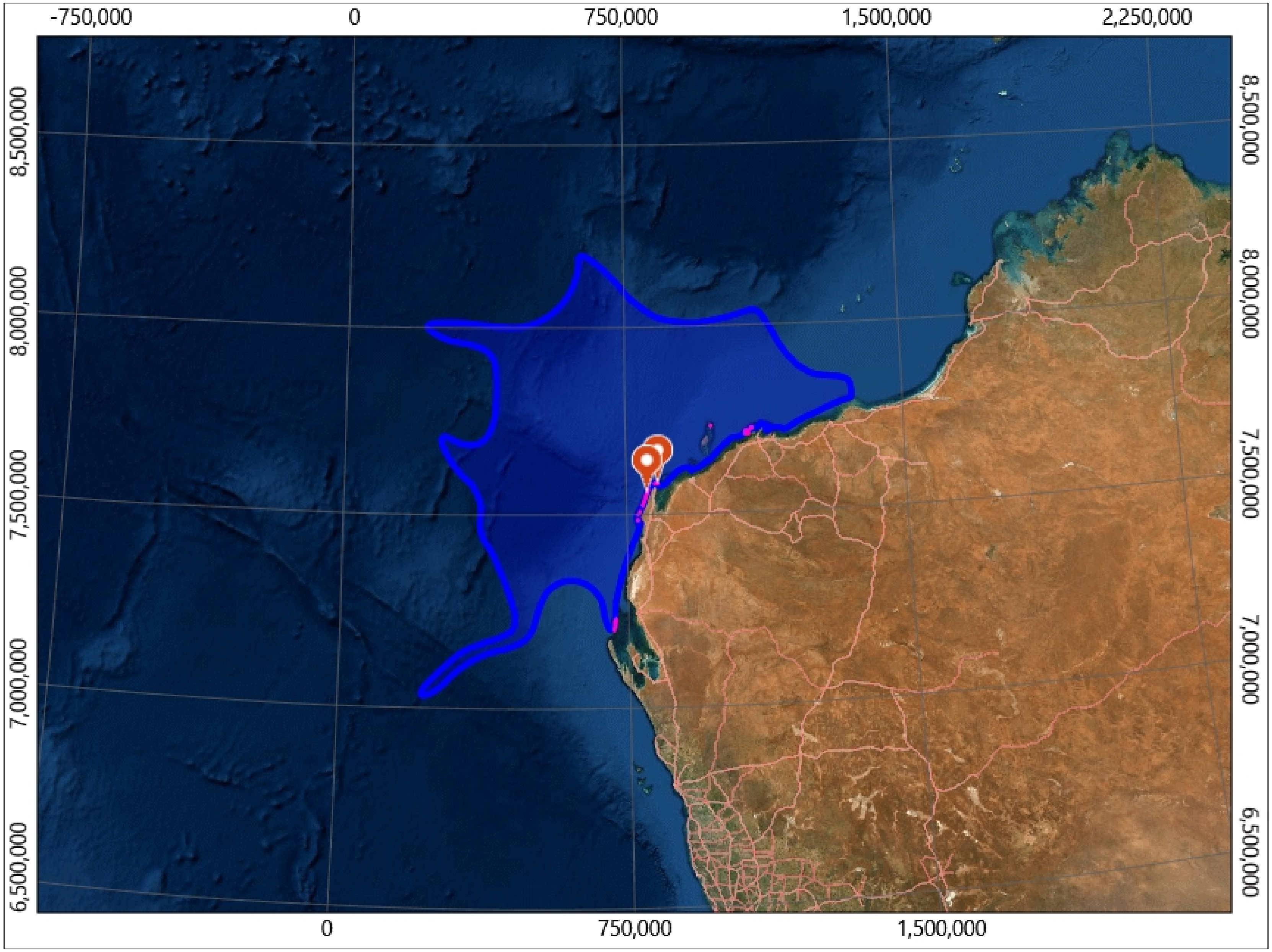


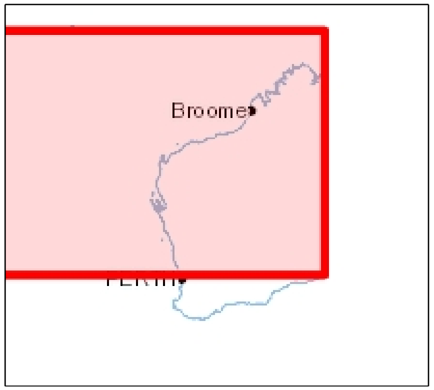
Legend

- Registered Aboriginal Site
- Search Area
- Town
- Road
- River
- Local Government Authority

546.06 kilometres

Map Scale 1 : 16,550,000

MGA Zone 49 (GDA94)



Aboriginal Heritage Inquiry System

List of Other Heritage Places

Search Criteria

No Other Heritage Places in Shapefile - Scarb_SIPLE_Ops_Area

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

Coordinate Accuracy

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Department of Planning, Lands and Heritage

Aboriginal Heritage Inquiry System

Map of Other Heritage Places

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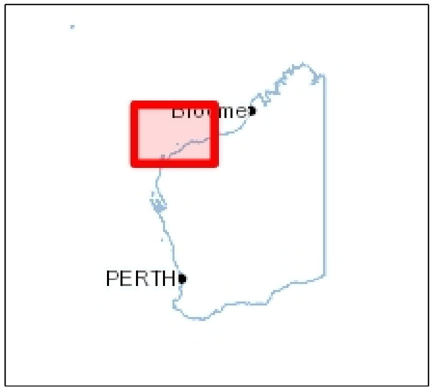
Legend

- Other Heritage Place
- Search Area
- Town
- Road
- River
- Local Government Authority

132.19 kilometres

Map Scale 1 : 4,010,000

MGA Zone 50 (GDA94)



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Map of Registered Aboriginal Sites

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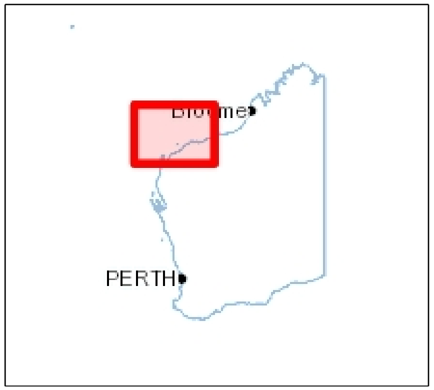
Legend

- Registered Aboriginal Site
- Search Area
- Town
- Road
- River
- Local Government Authority

132.19 kilometres

Map Scale 1 : 4,010,000

MGA Zone 50 (GDA94)



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Identifier: 559705

APPENDIX H. MASTER EXISTING ENVIRONMENT

Description of the 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.

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.

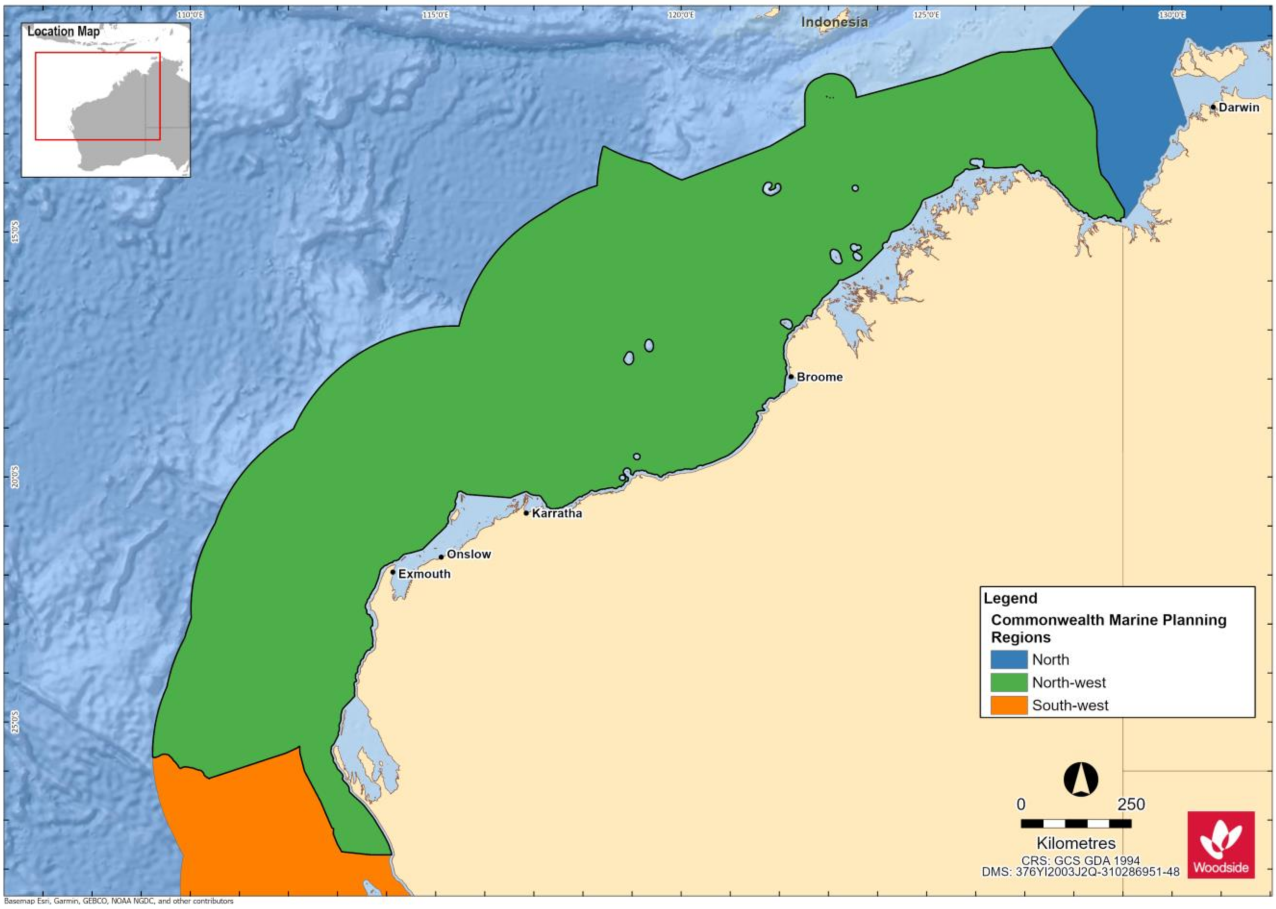

Figure 1-1. Marine Bioregions: North-west (NWMR), South-west (SWMR) and North (NMR)

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**.

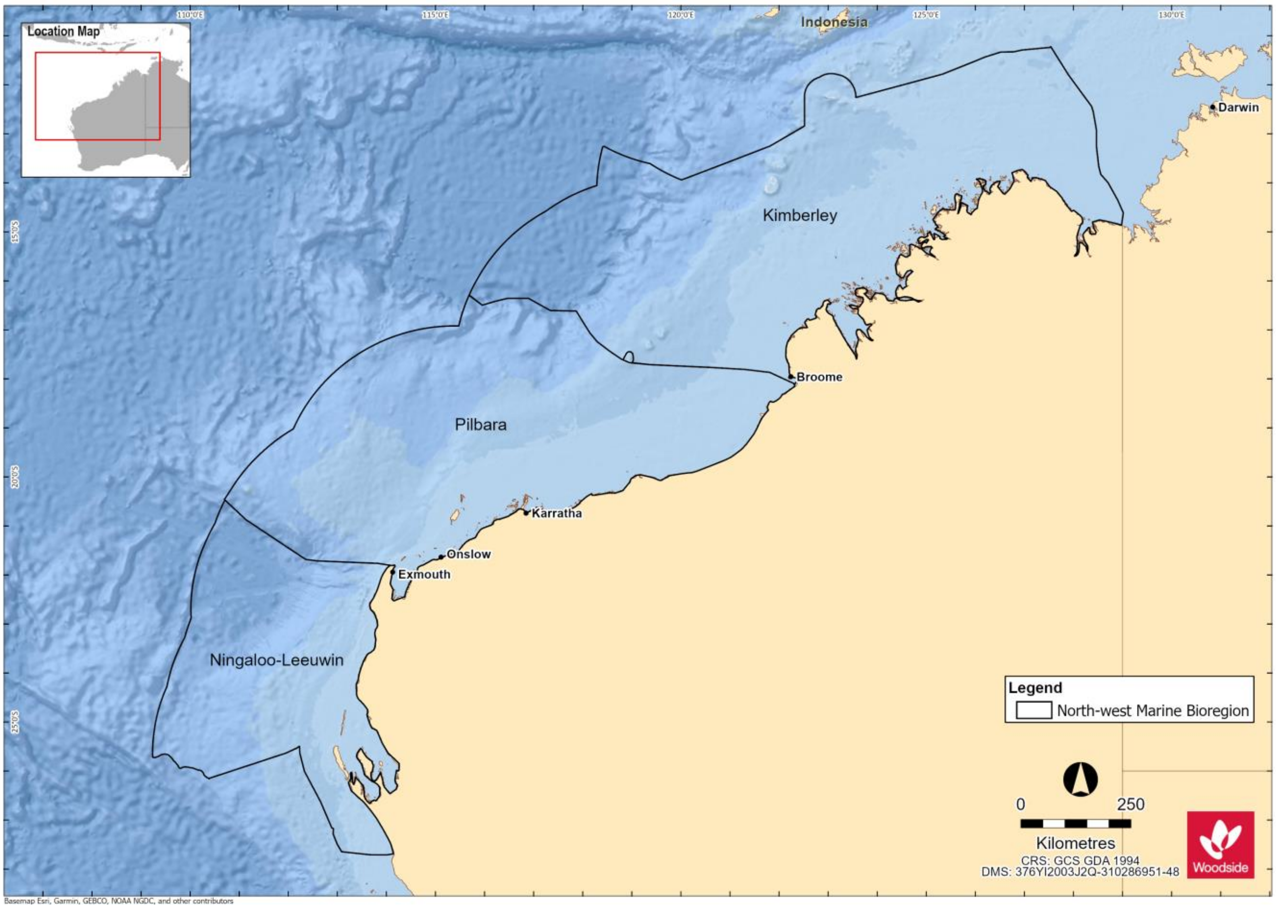

Figure 2-1. The marine systems of the North-west Marine Region (NWMR)

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).

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.

[1] http://www.bom.gov.au/jsp/ncc/climate_averages/temperature/index.jsp, accessed 21 January 2021.

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).

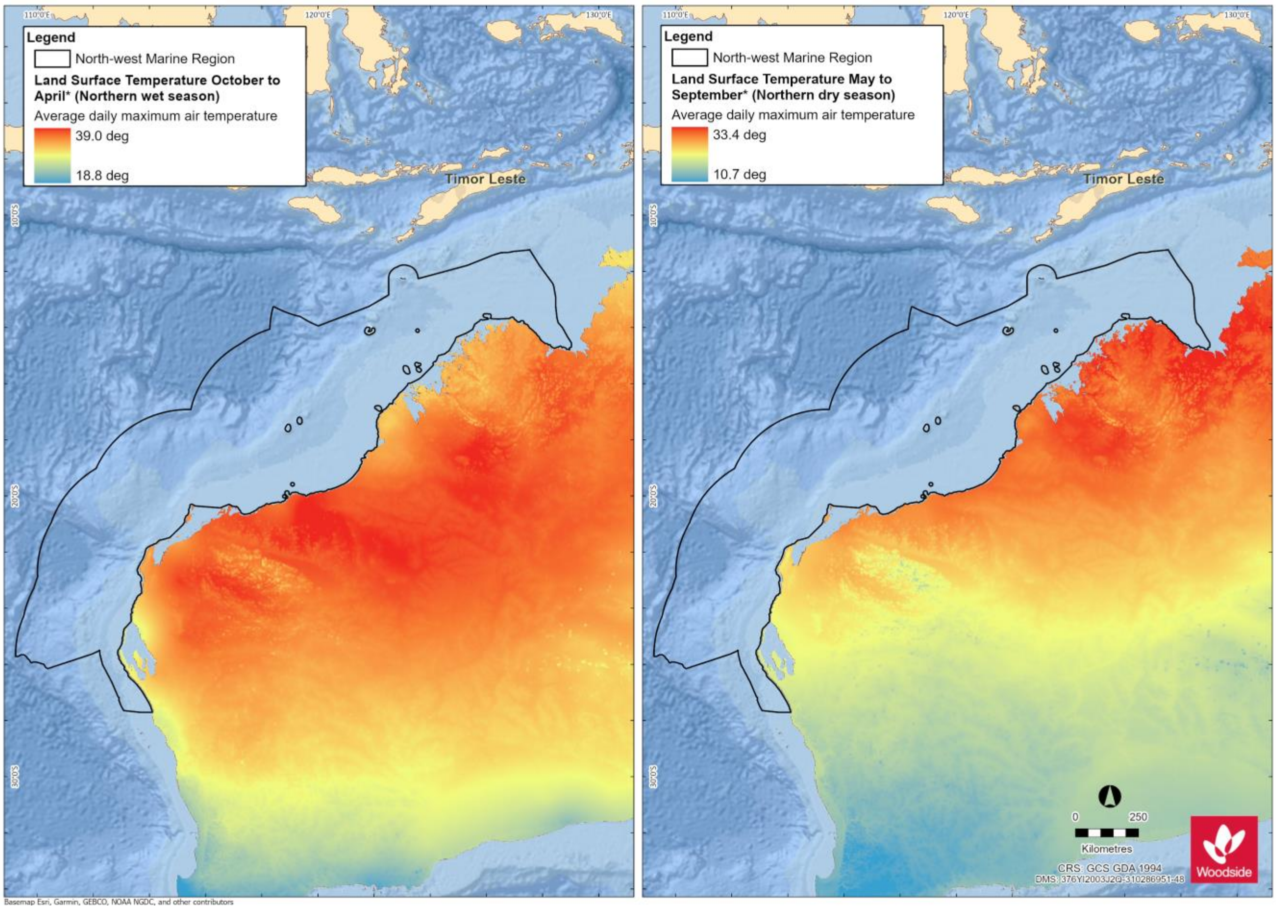

Figure 2-2. Average daily maximum air temperature for land surface adjacent to NWMR: (a) summer (northern wet season) and (b) winter (northern dry season)

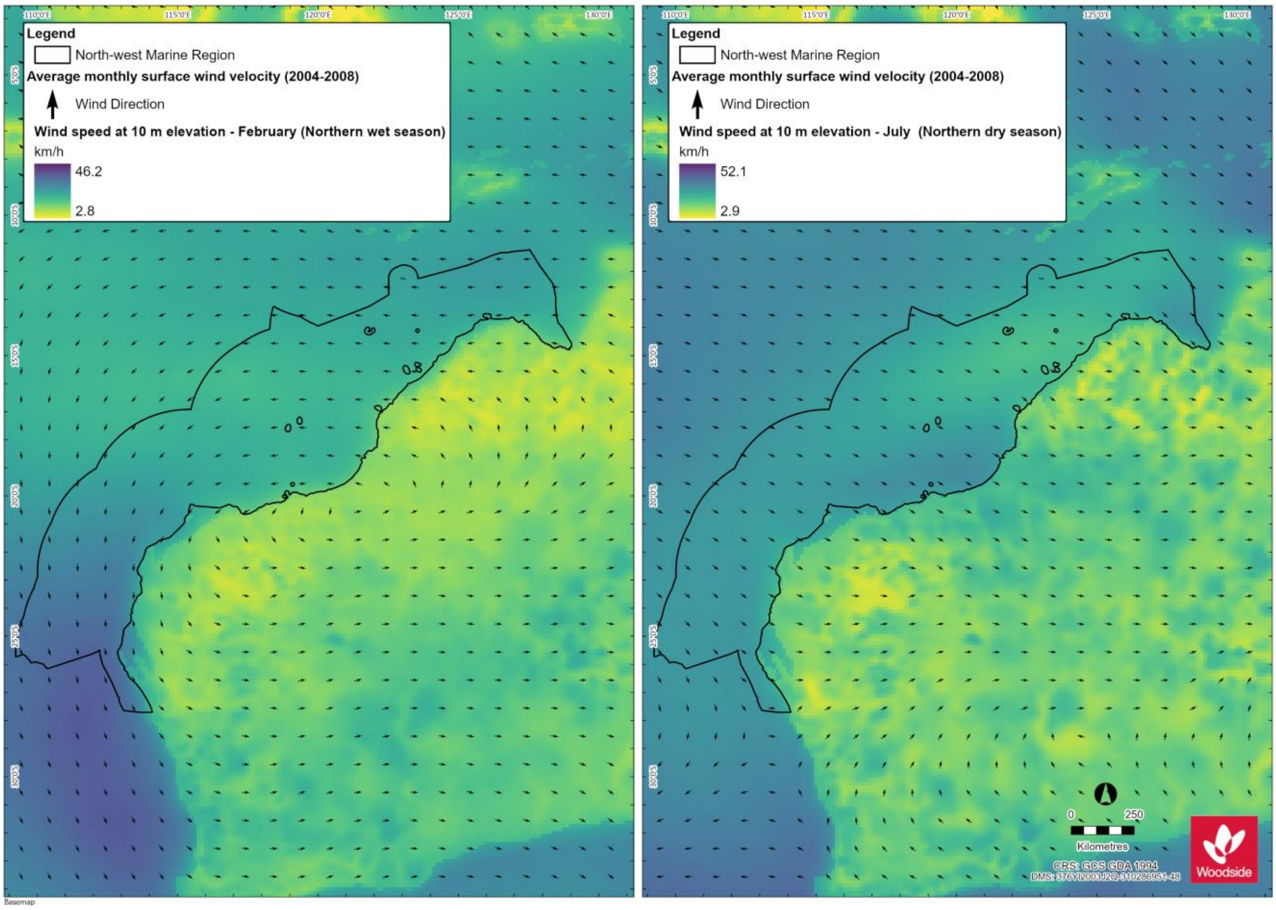

Figure 2-3. Average monthly surface wind direction and velocity for NWMR: (a) summer (February, northern wet season) and (b) winter (July, northern dry season)

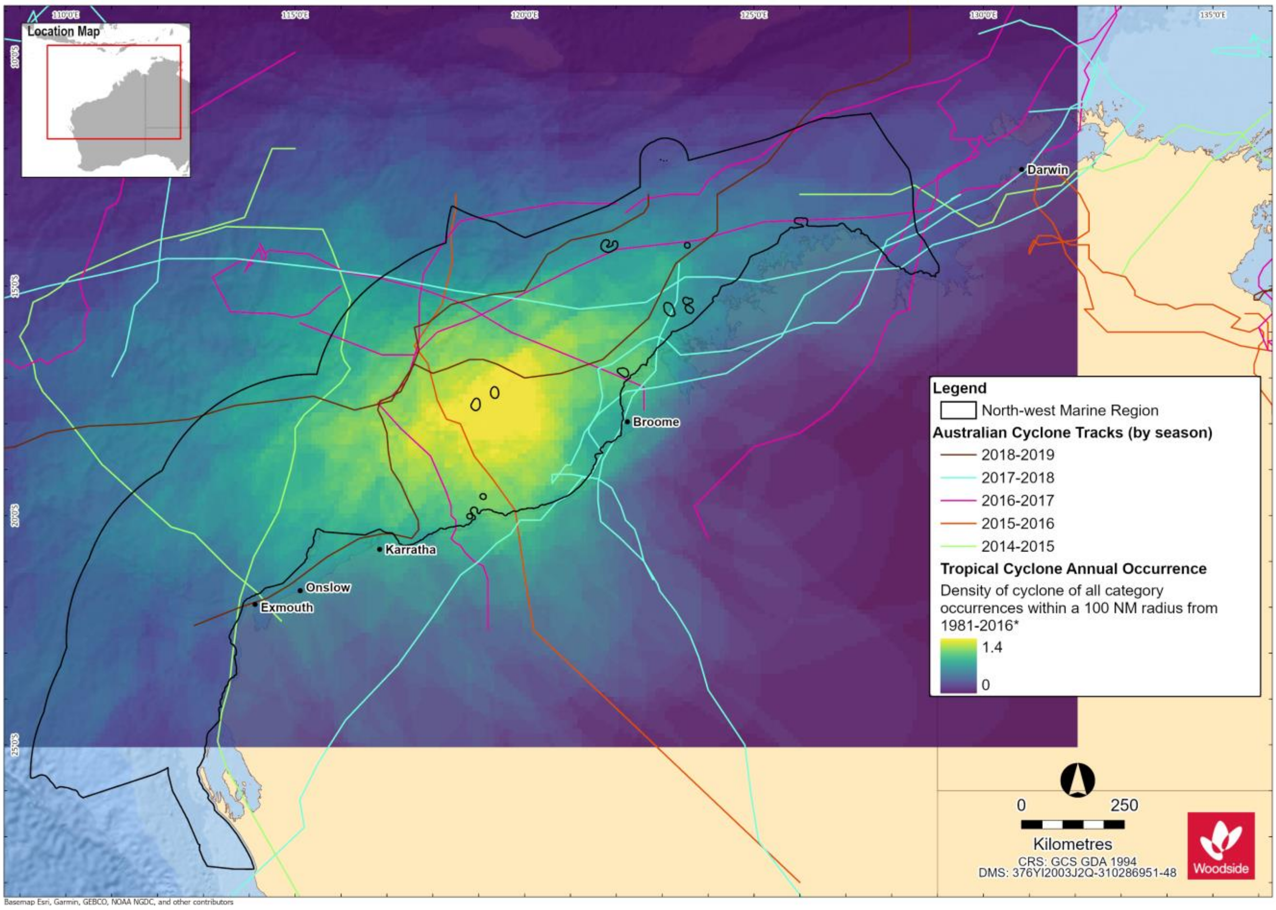

Figure 2-4. Tropical cyclone annual occurrence and cyclone tracks for NWMR

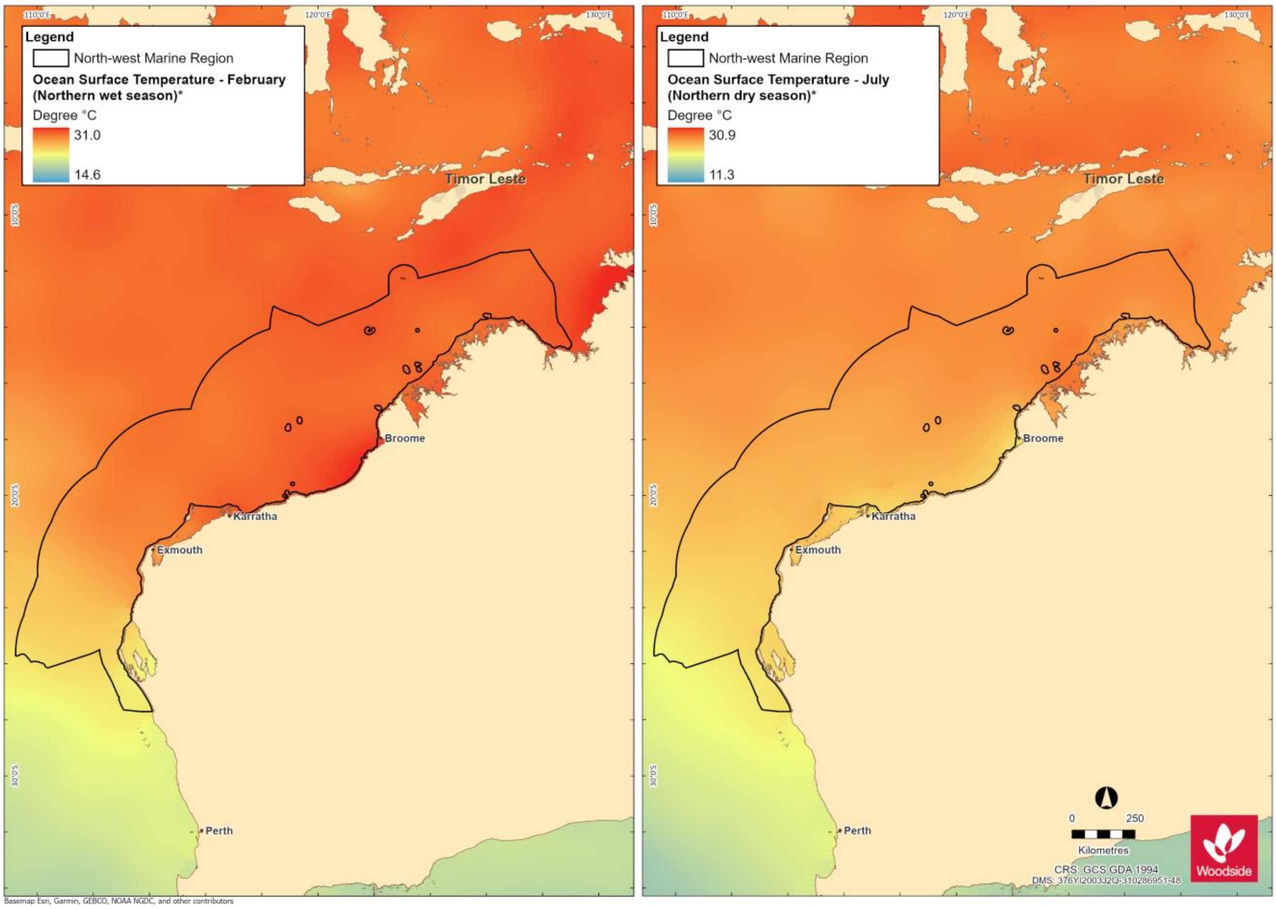

Figure 2-5. Ocean surface temperature for NWMR: (a) summer (February, northern wet season) and (b) winter (July, northern dry season)

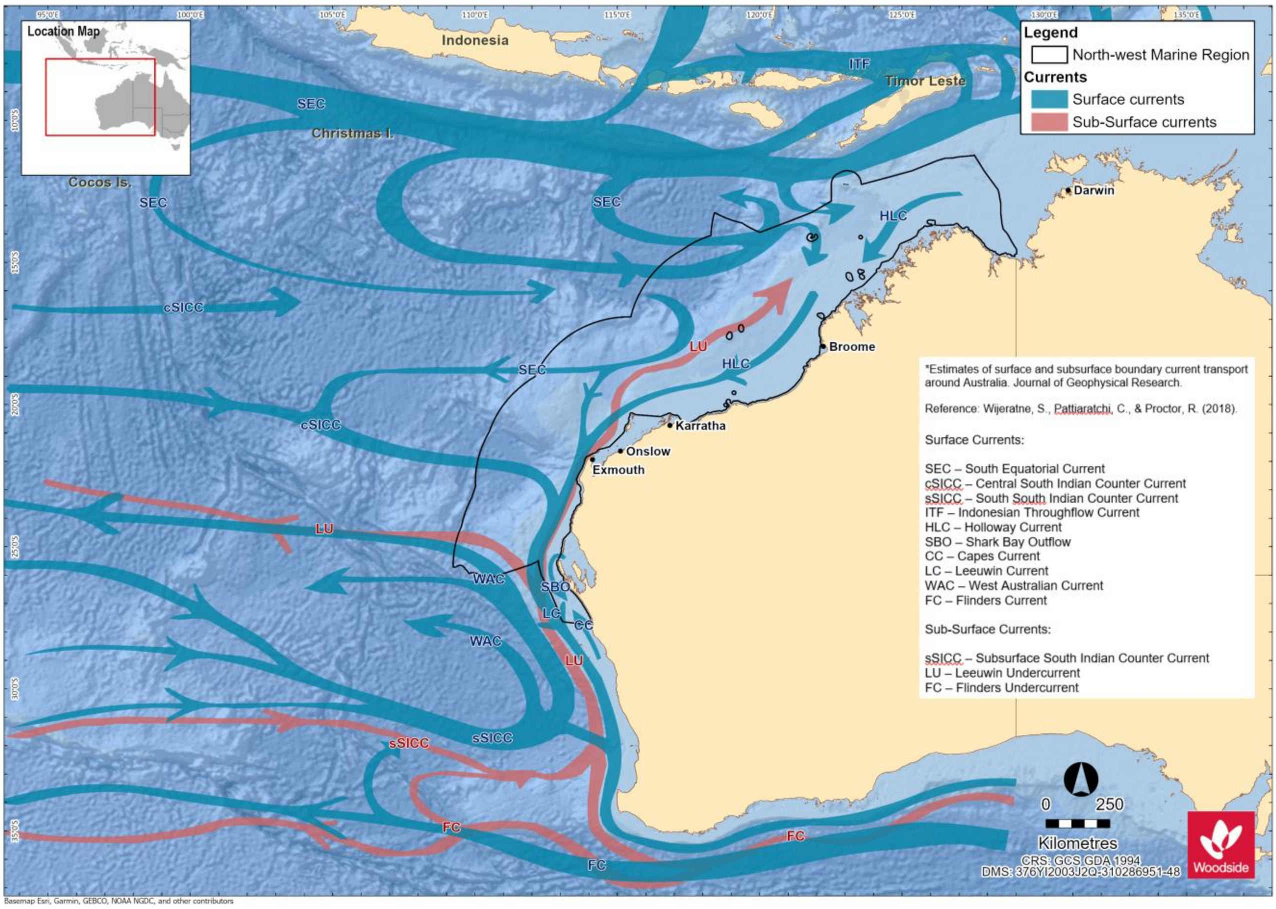

Figure 2-6. Ocean surface and sub-surface currents of the NWMR and wider region

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).

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**.

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.

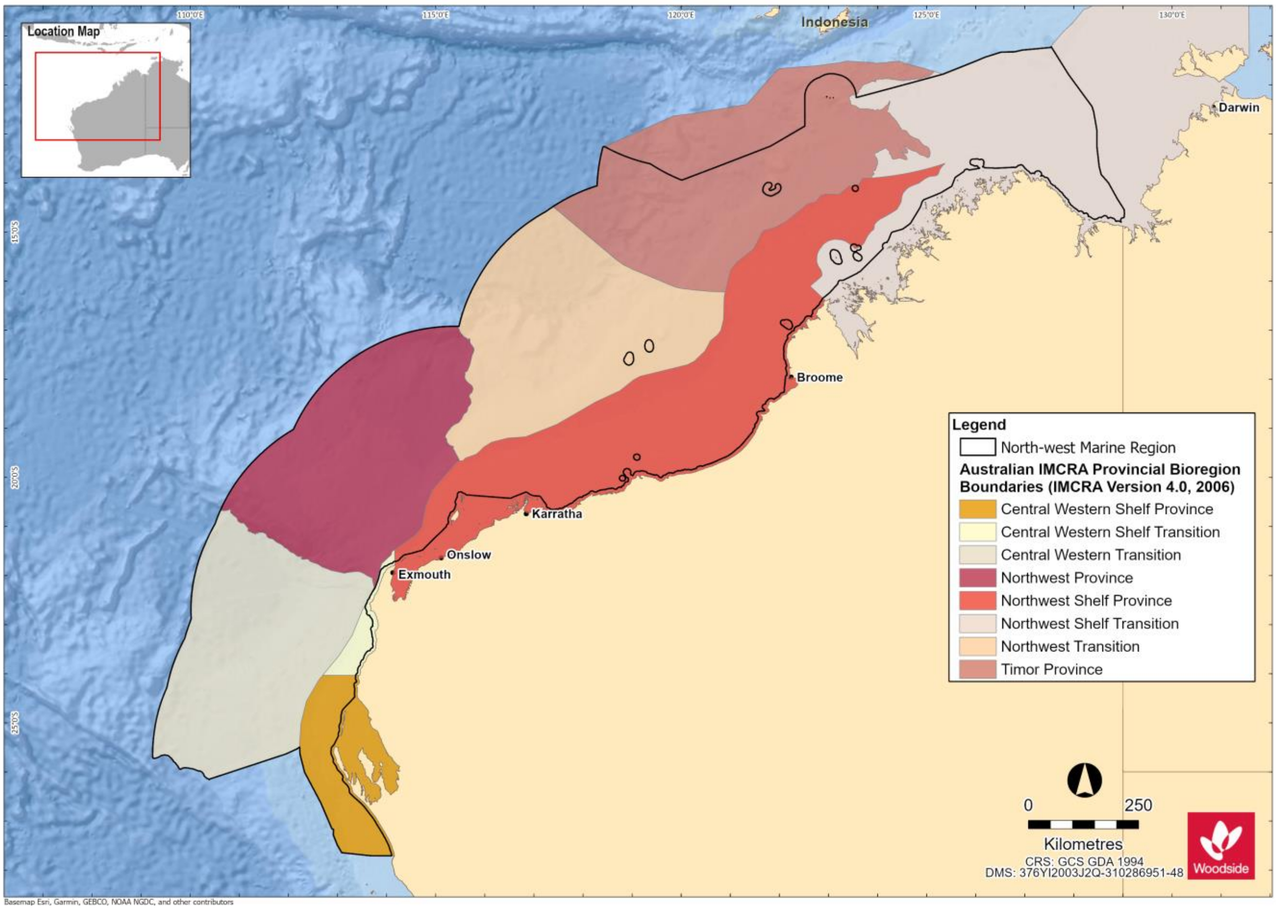

Figure 2-7. The eight provincial bioregions of the NWMR (Commonwealth of Australia, 2006)

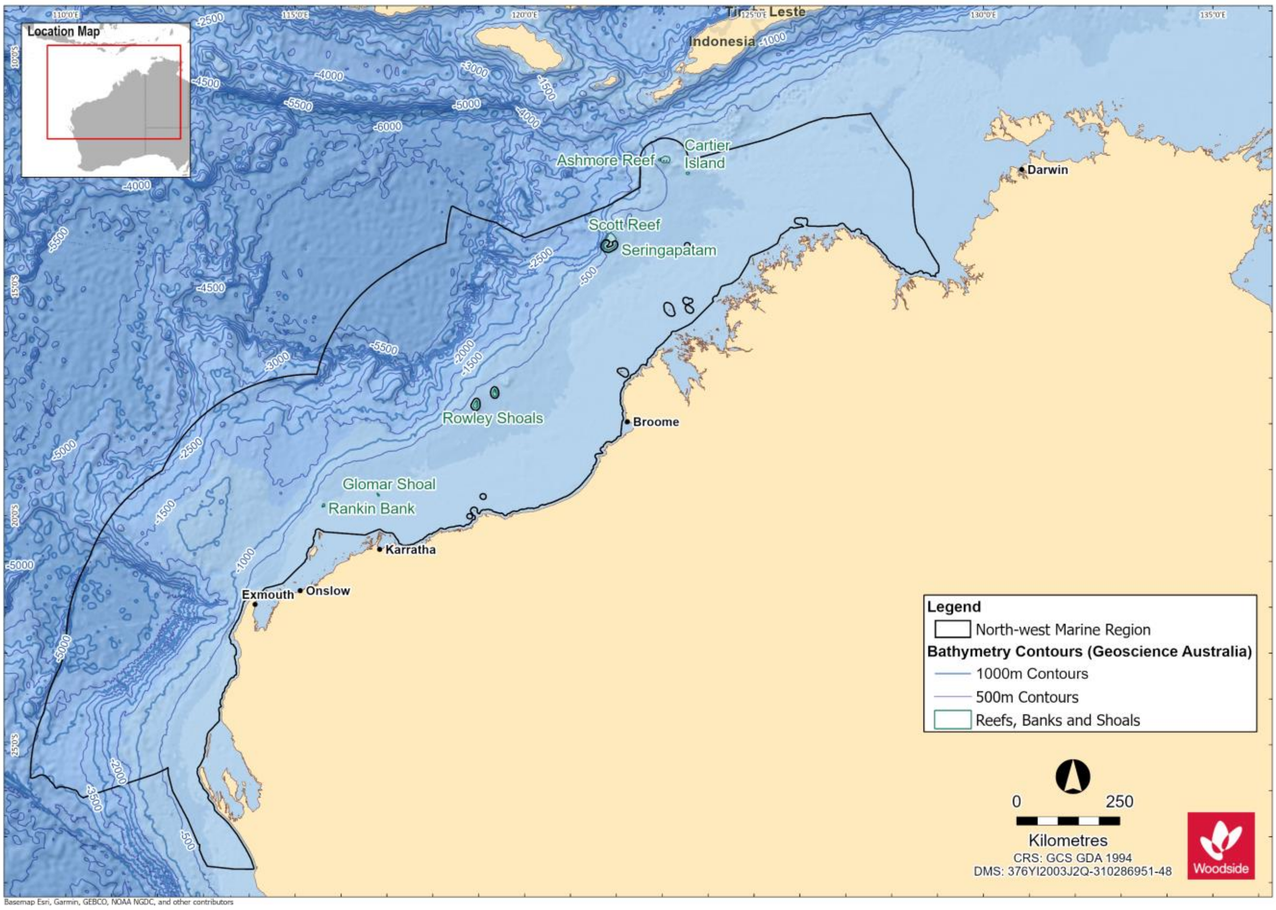

Figure 2-8. Bathymetry of the NWMR

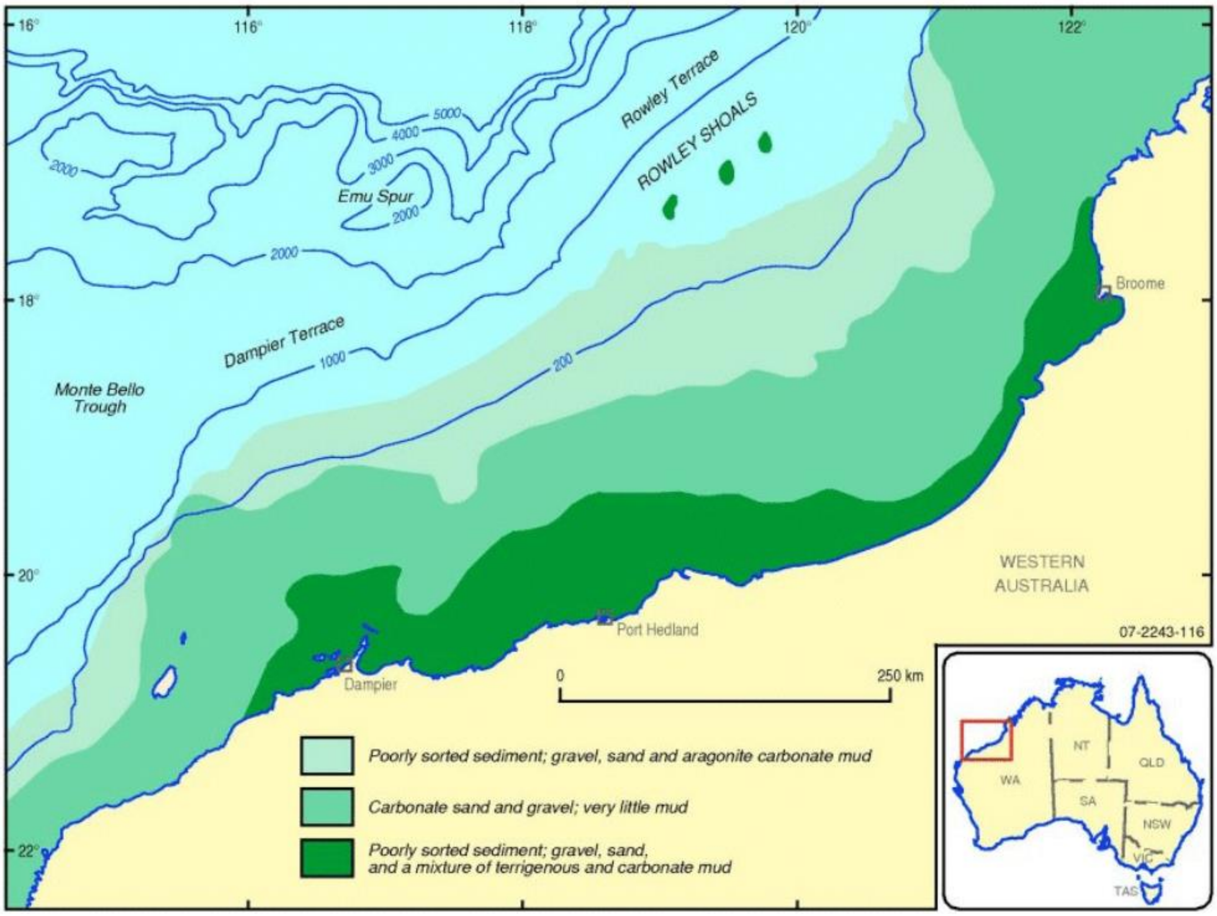

Figure 2-9. Overview of the seabed sediments of the NWMR (Baker *et al*., 2008)

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).

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**).*

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

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

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**).

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)

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)

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 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.

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).

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**.

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**

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	

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	

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

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

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

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

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.

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

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.

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.

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).

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

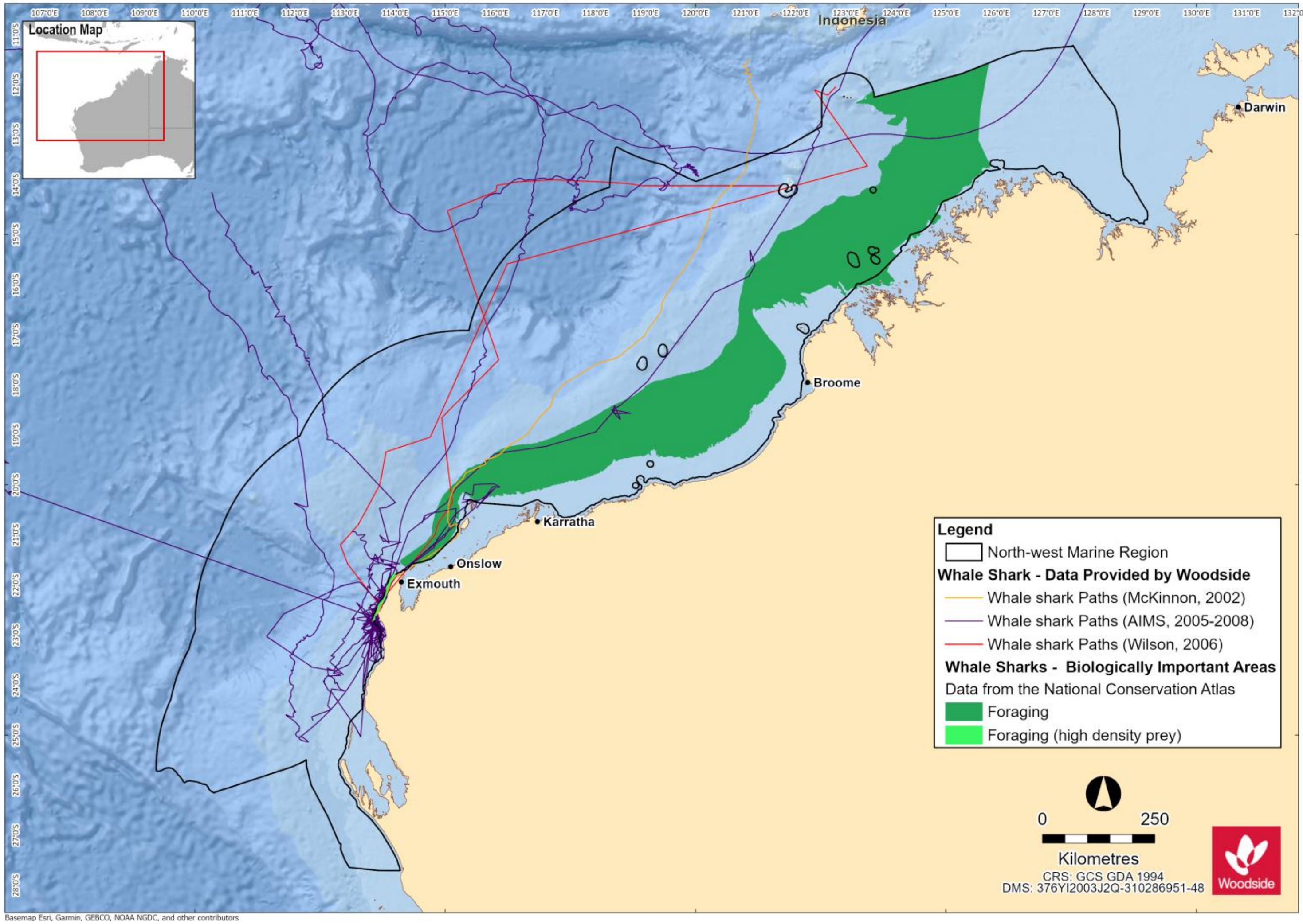

Figure 5-1 Whale shark BIAs for the NWMR and tagged whale shark tracks

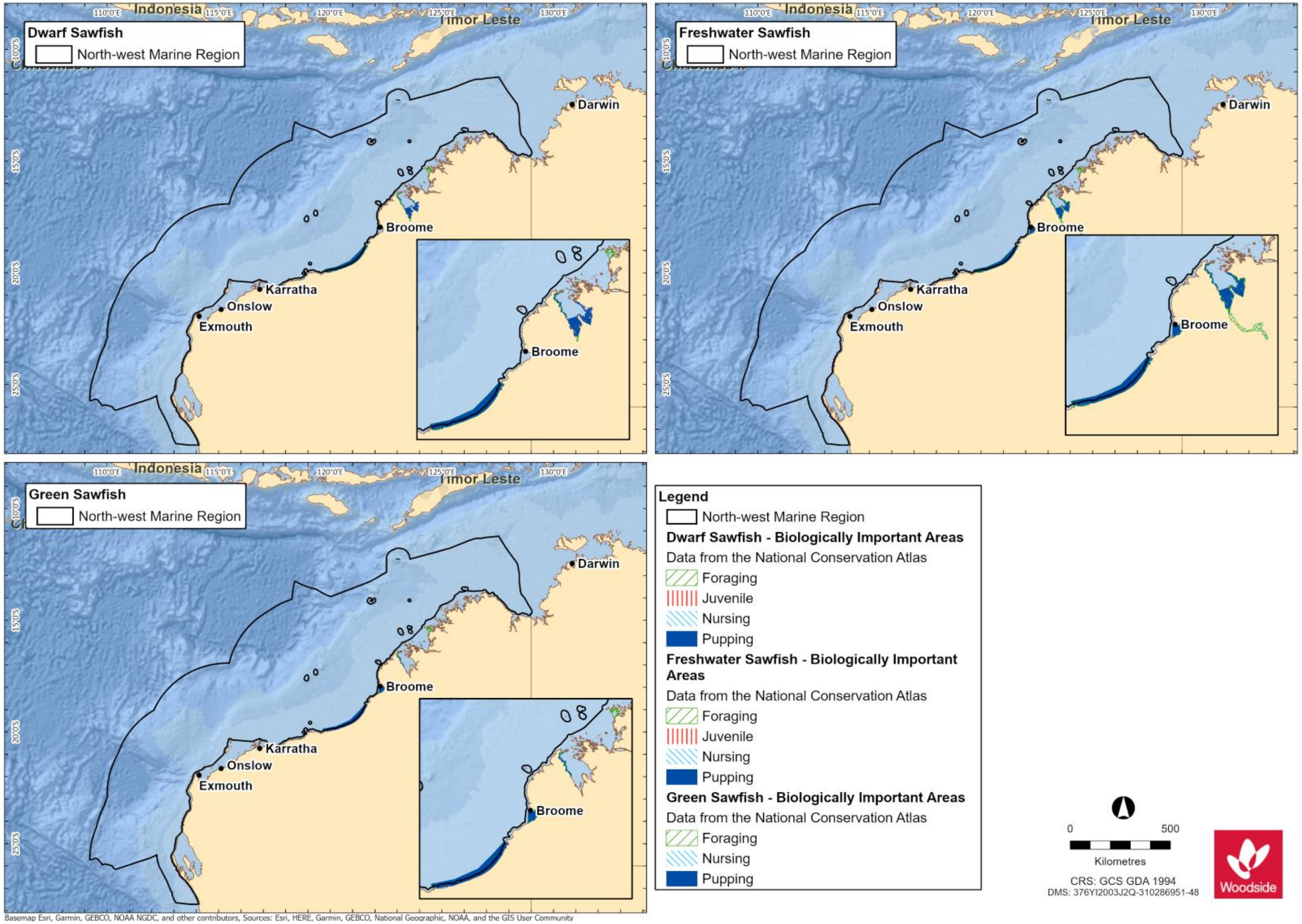

Figure 5-2 Sawfish BIAs for the NWMR

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.

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.

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.

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

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).

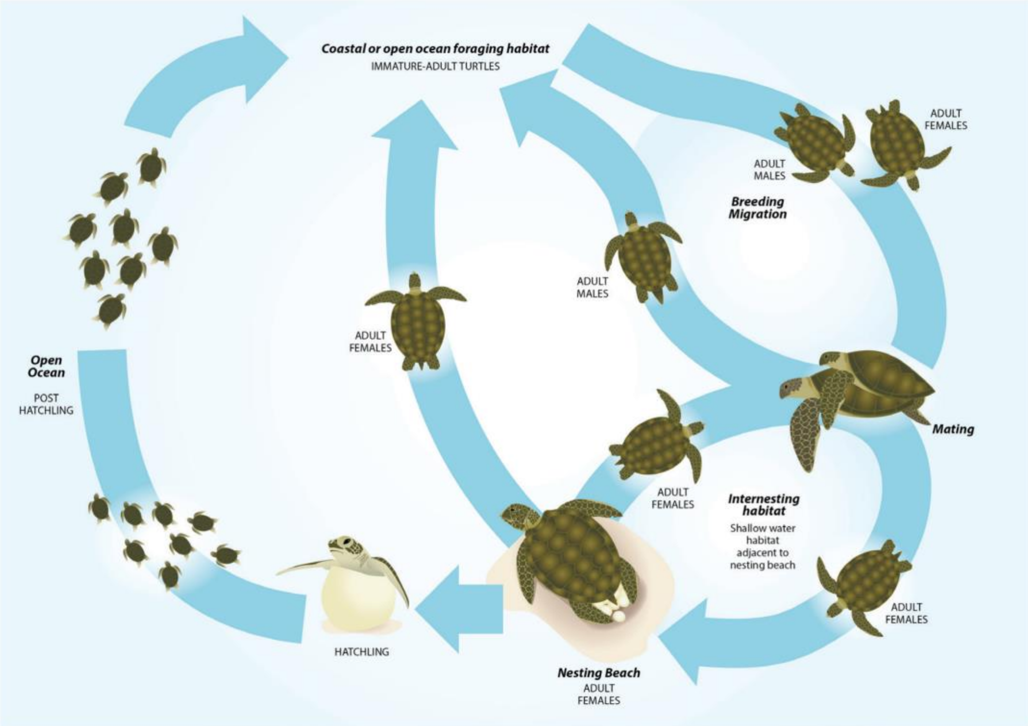

Figure 6-1 Generalised life cycle of marine turtles (Commonwealth of Australia, 2017)

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	

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)

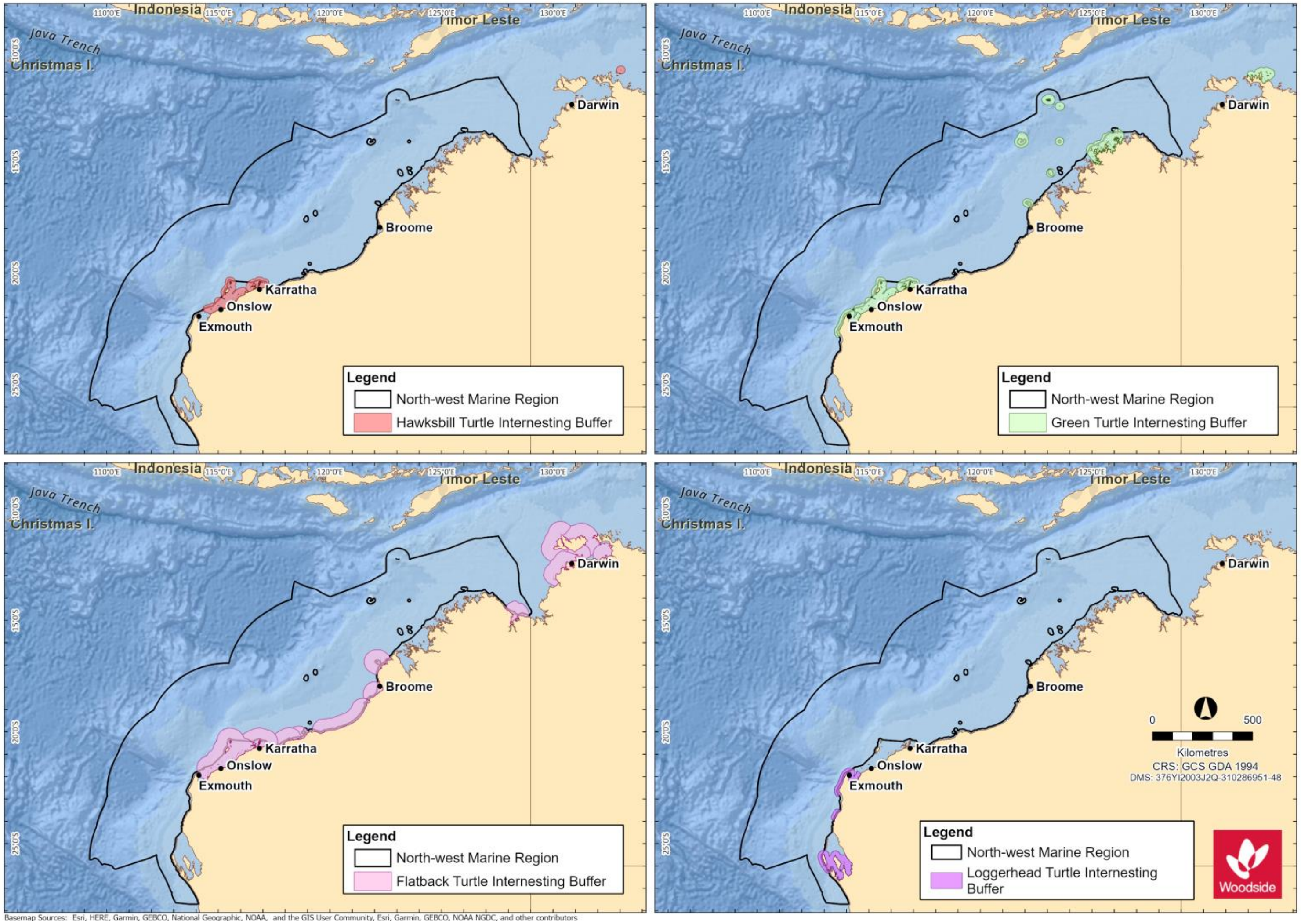

Figure 6-2 Marine turtle species habitat critical to survival (nesting beaches and internesting buffers) for the NWMR

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**).

[2] http://www.environment.gov.au/webgis-framework/apps/ncva/ncva.jsf

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).

[3] Migration BIA does not exist for Marine Turtles – general information provided.

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).

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.

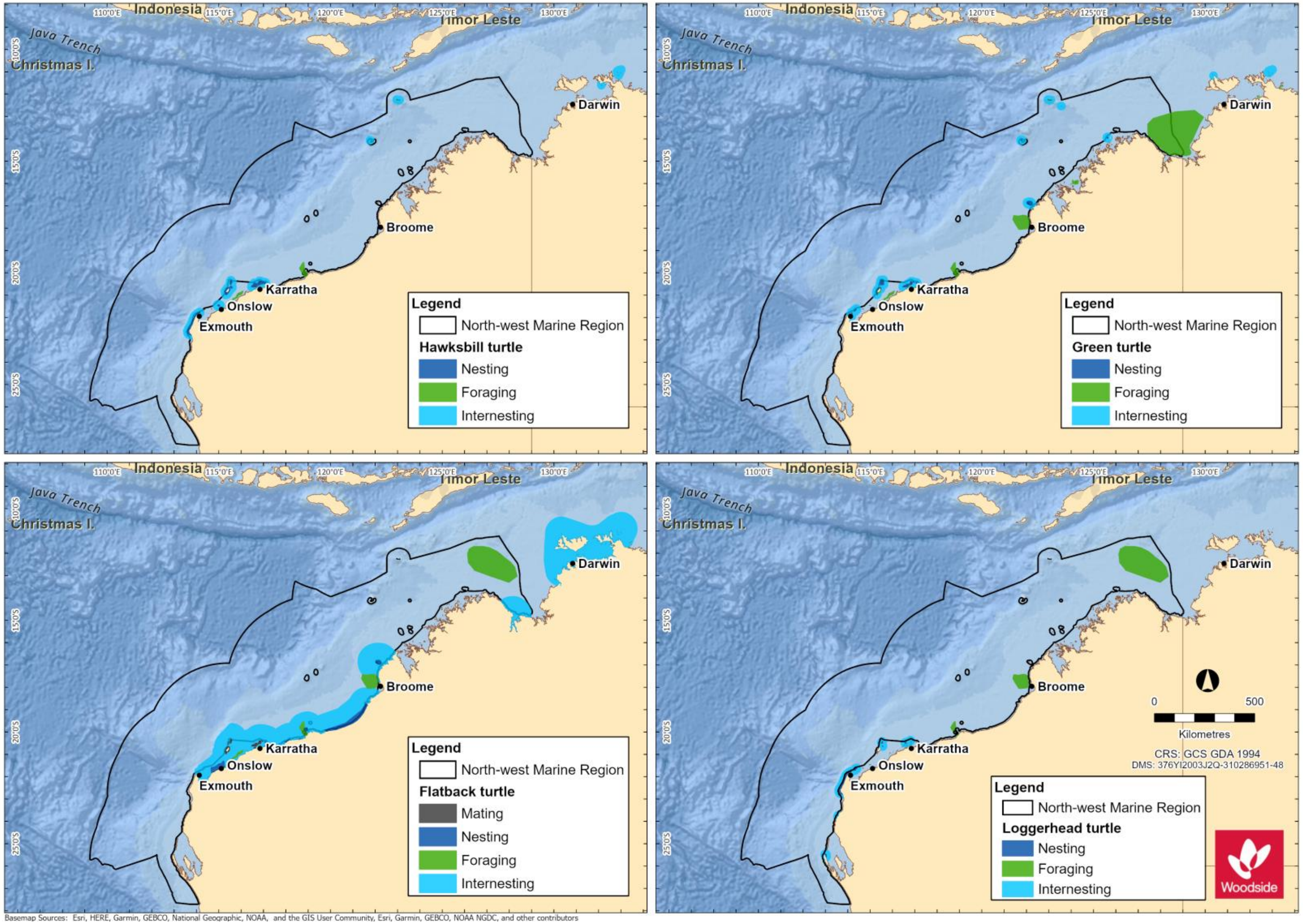

Figure 6-3 Marine turtle species BIAs within the NWMR

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).

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.

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).

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).

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.

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.

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

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)

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.

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

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

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

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

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.

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**.

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

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

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)*

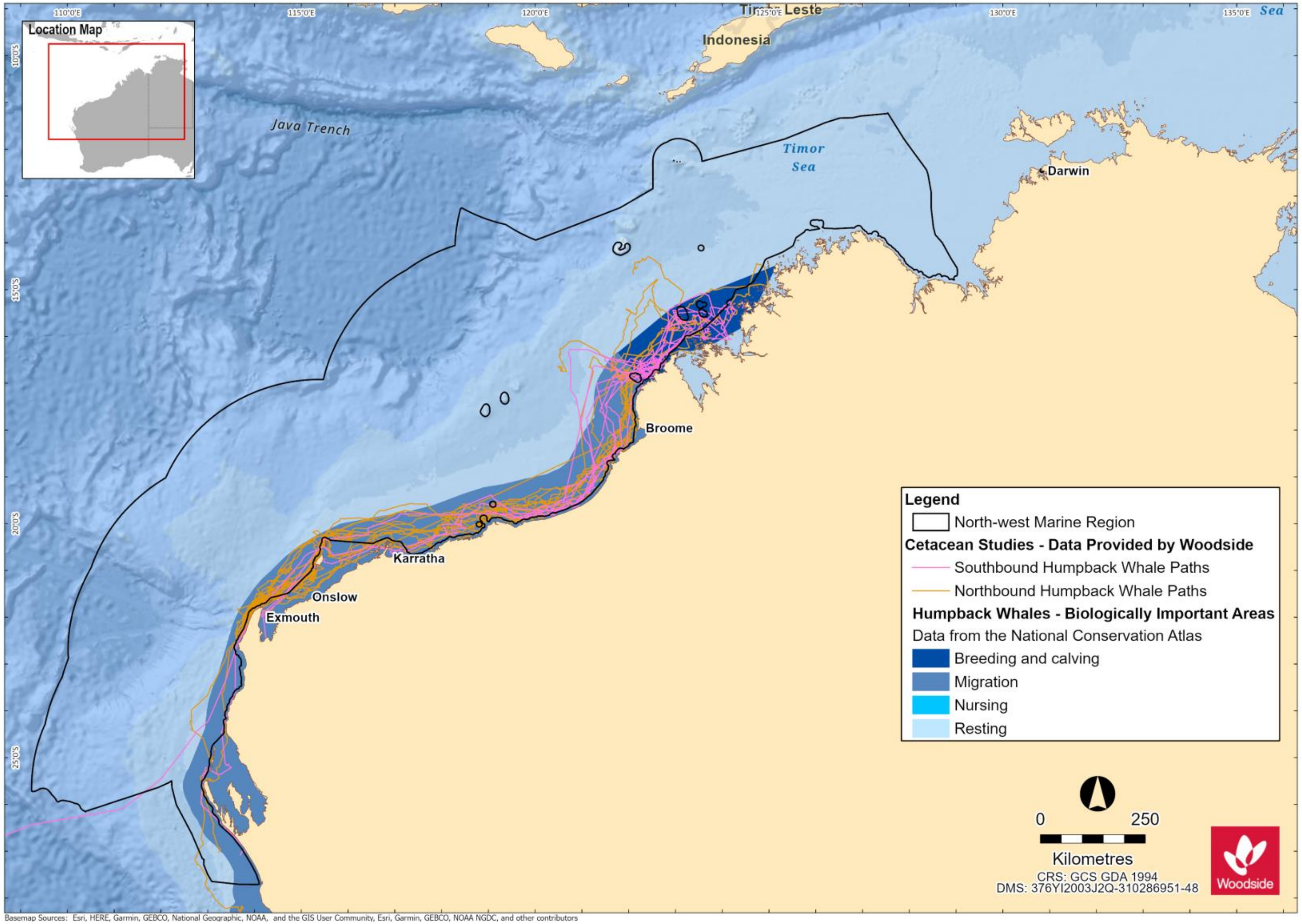

Figure 7-1 Humpback whale BIAs for the NWMR and tagged tracks for north and south bound migrations

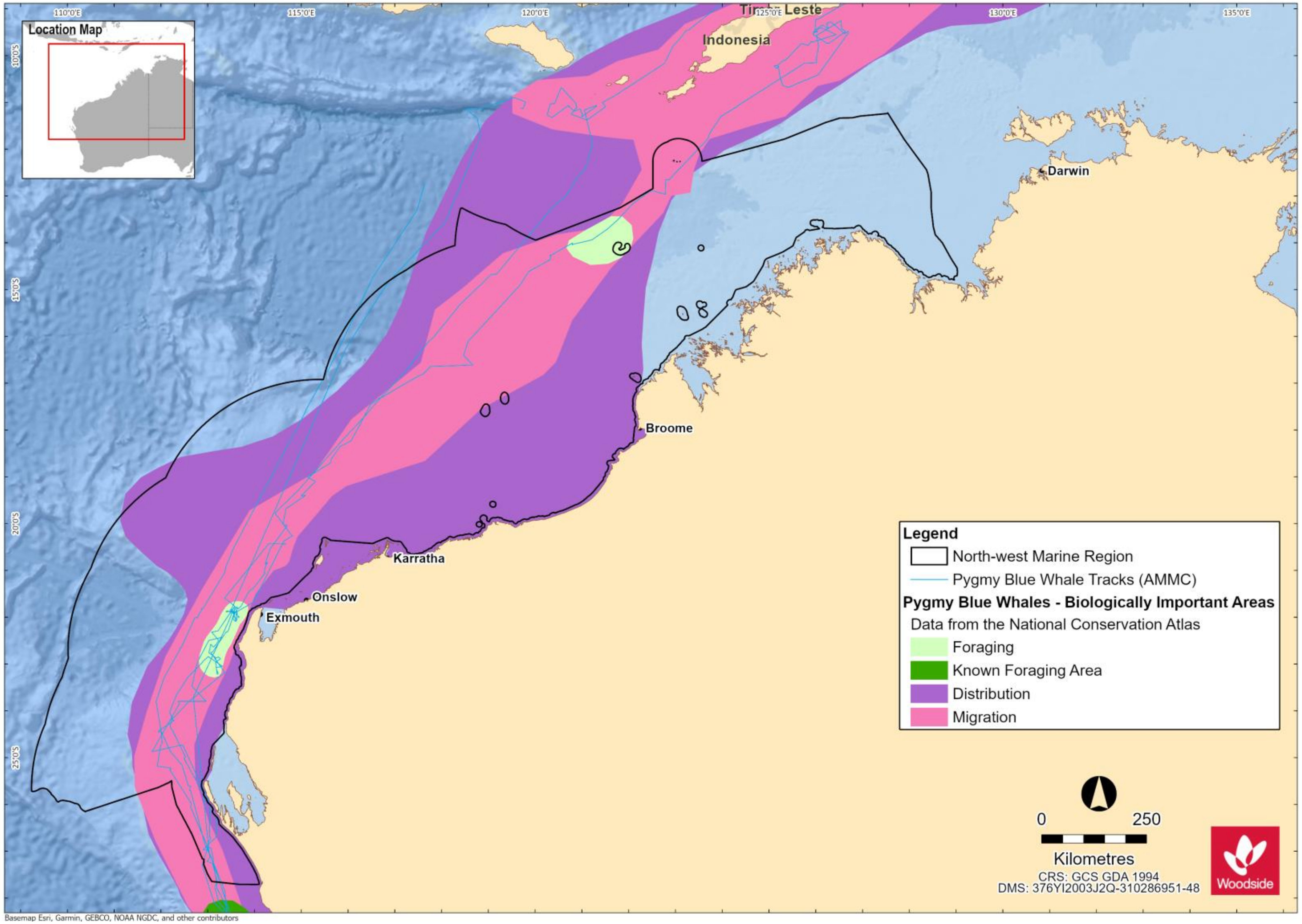

Figure 7-2 Pygmy blue whale BIAs for the NWMR and tagged whale tracks for northbound migration

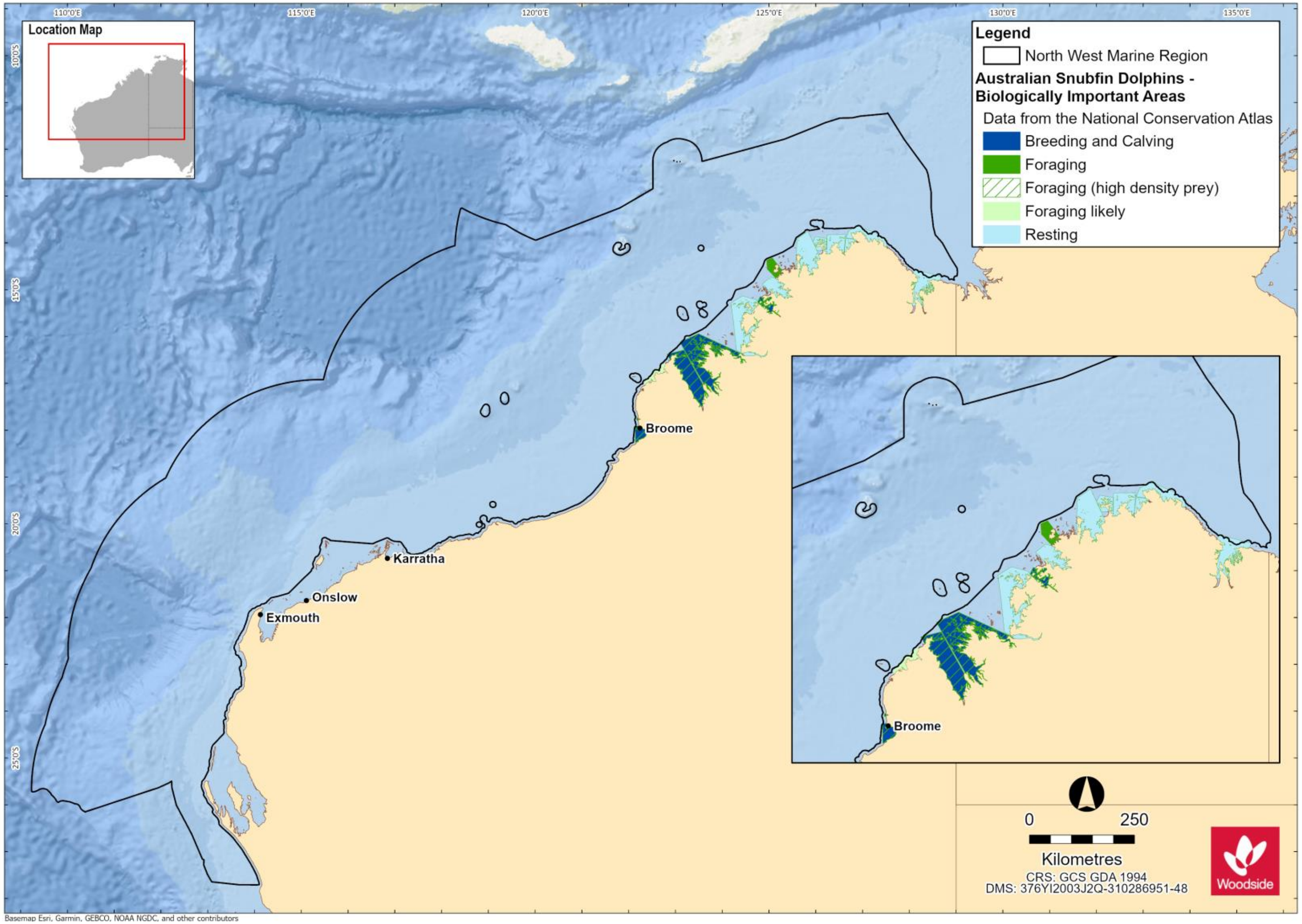

Figure 7-3 Australian snubfin dolphin BIAs for the NWMR

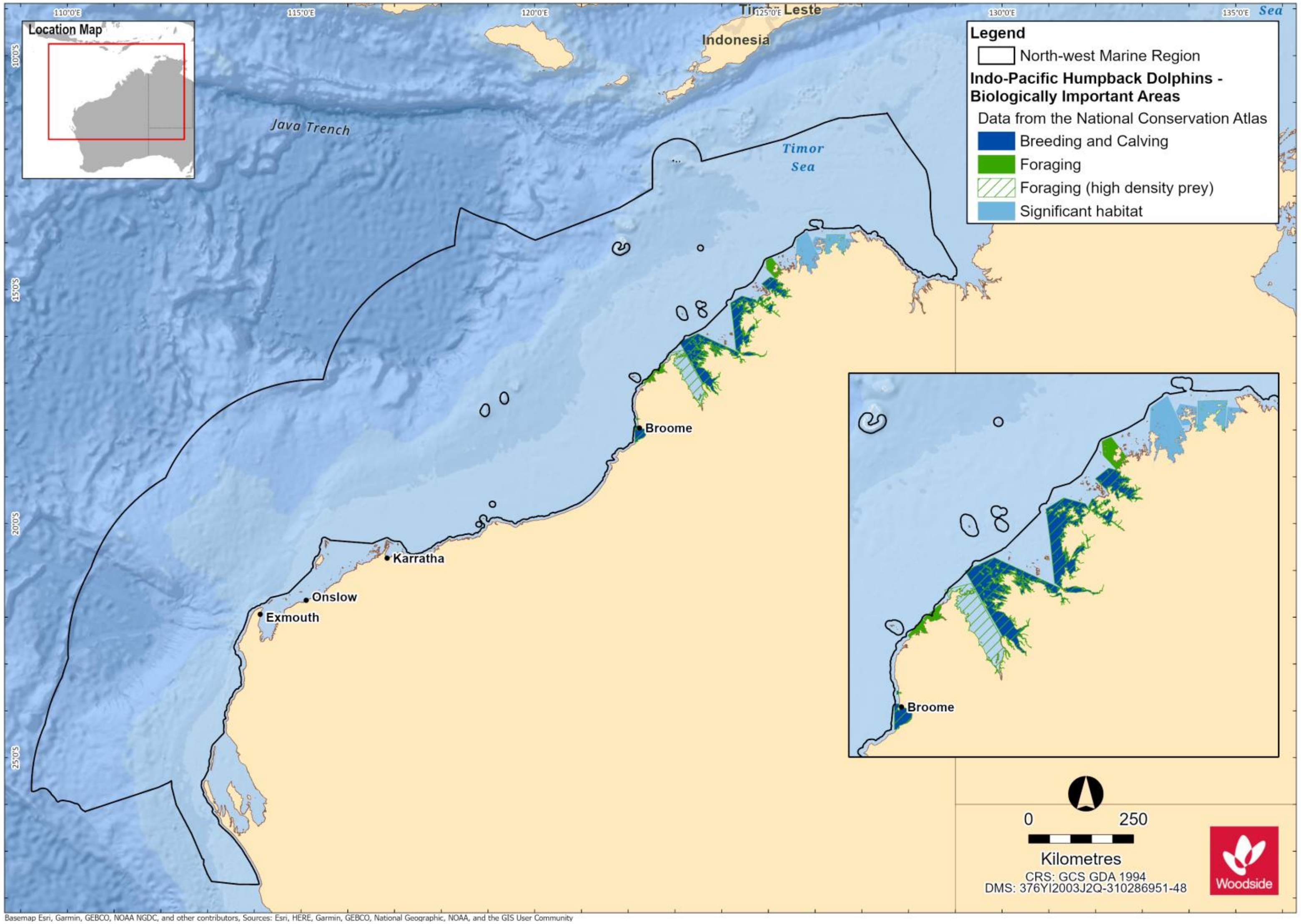

Figure 7-4 Indo-Pacific humpback dolphin BIAs for the NWMR

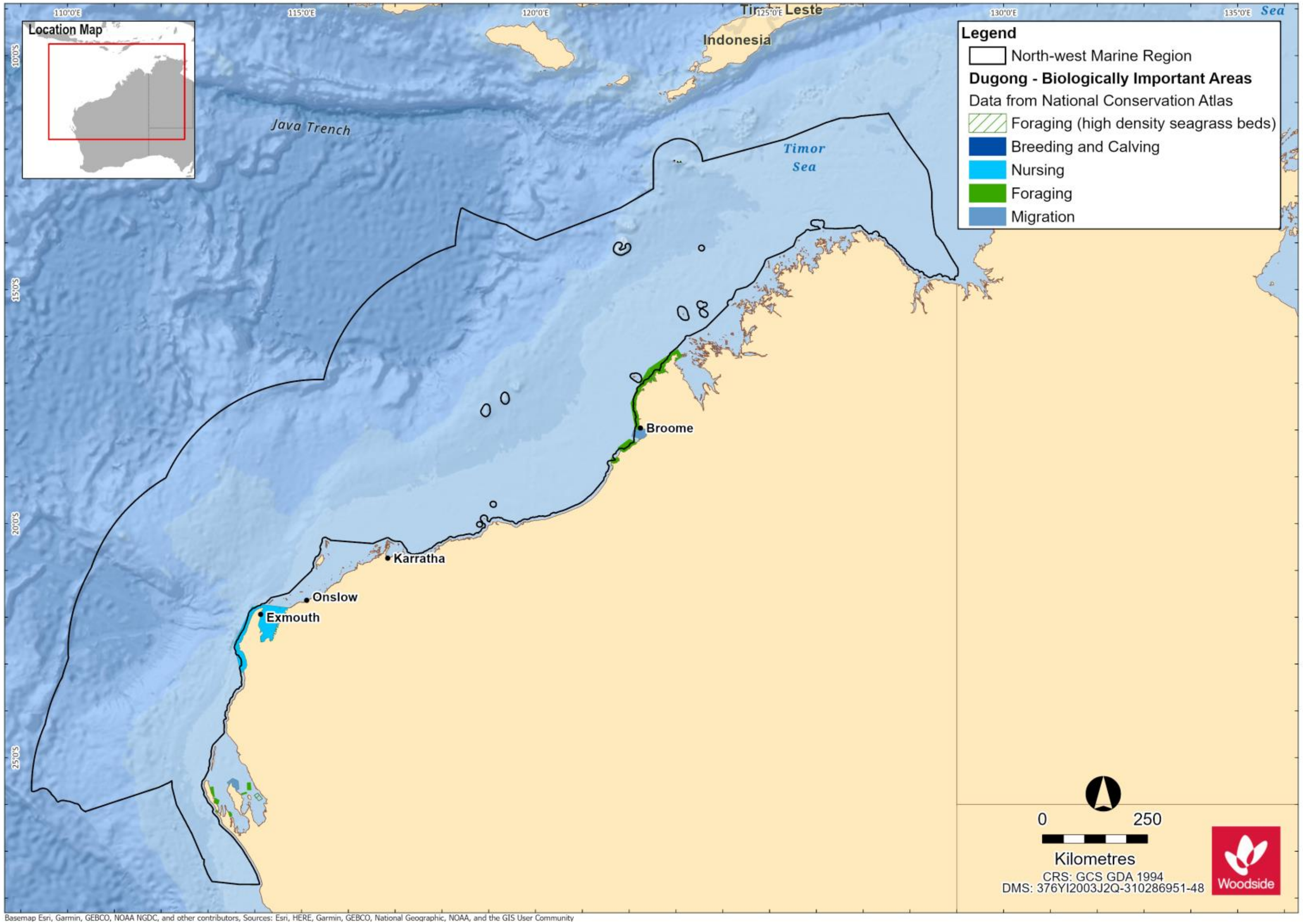

Figure 7-5 Dugong BIAs for the NWMR

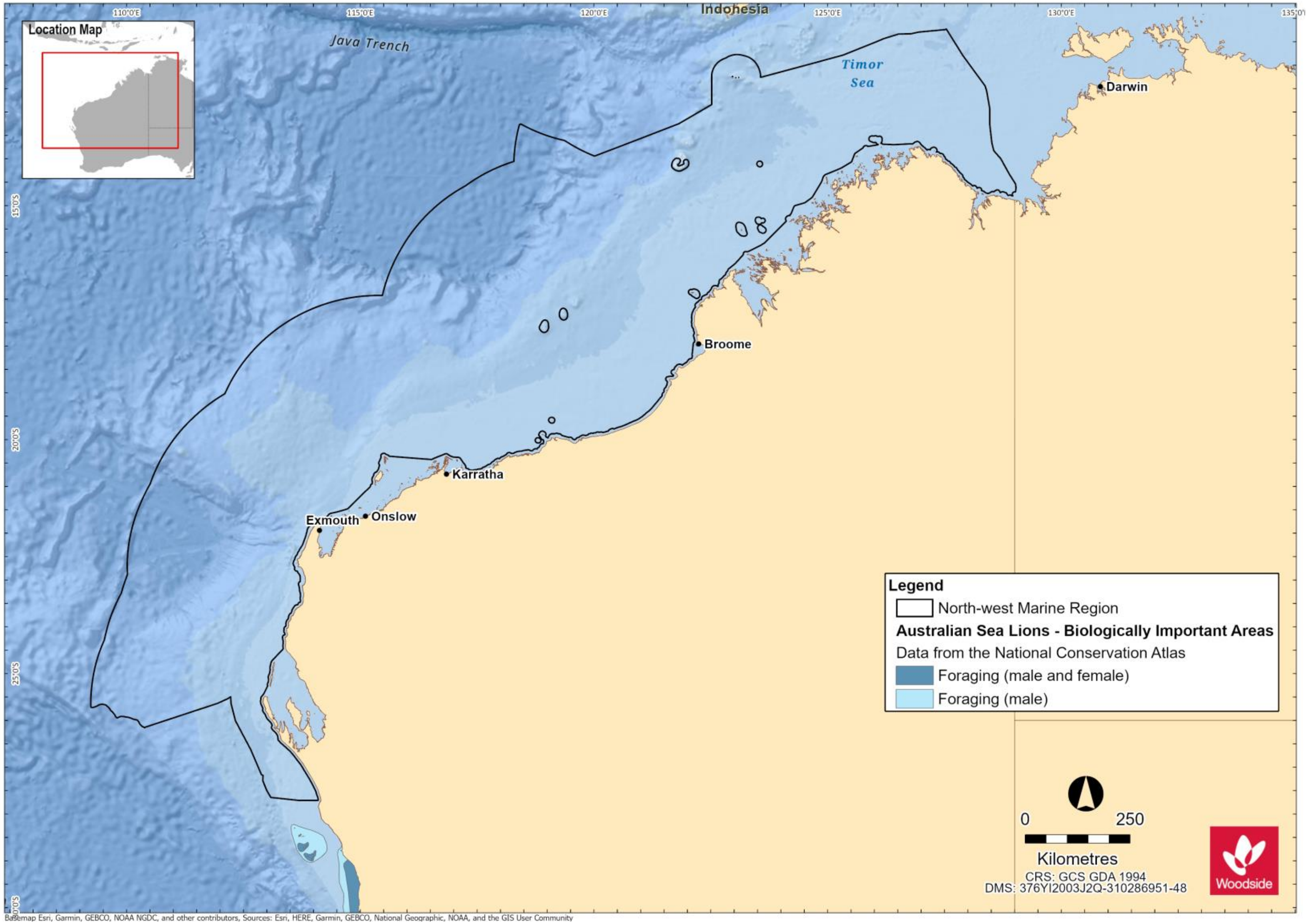

Figure 7-6 Australian sea lion BIAs in the northern extent of the SWMR closest to the NWMR

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**.

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.

4
https://www.birdlife.org.au/projects/KBA#:~:text=The%20Key%20Biodiversity%20Areas%20(KBAs,of%20advocacy%20for%20protected%20areas.
Accessed April, 2021.

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	

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)

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).					

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

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

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**.

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

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	

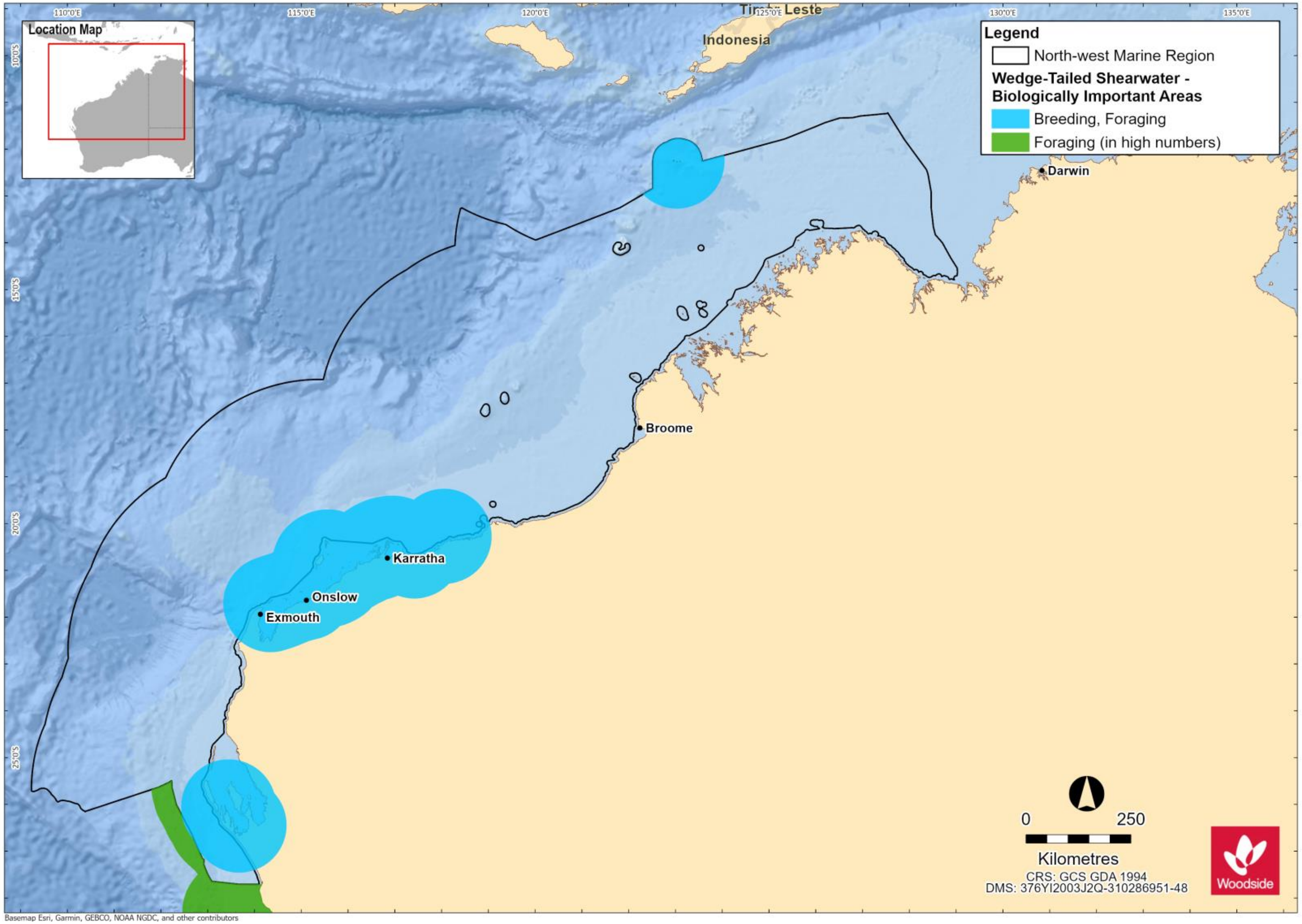

Figure 8-1 Wedge-tailed shearwater BIAs for the NWMR

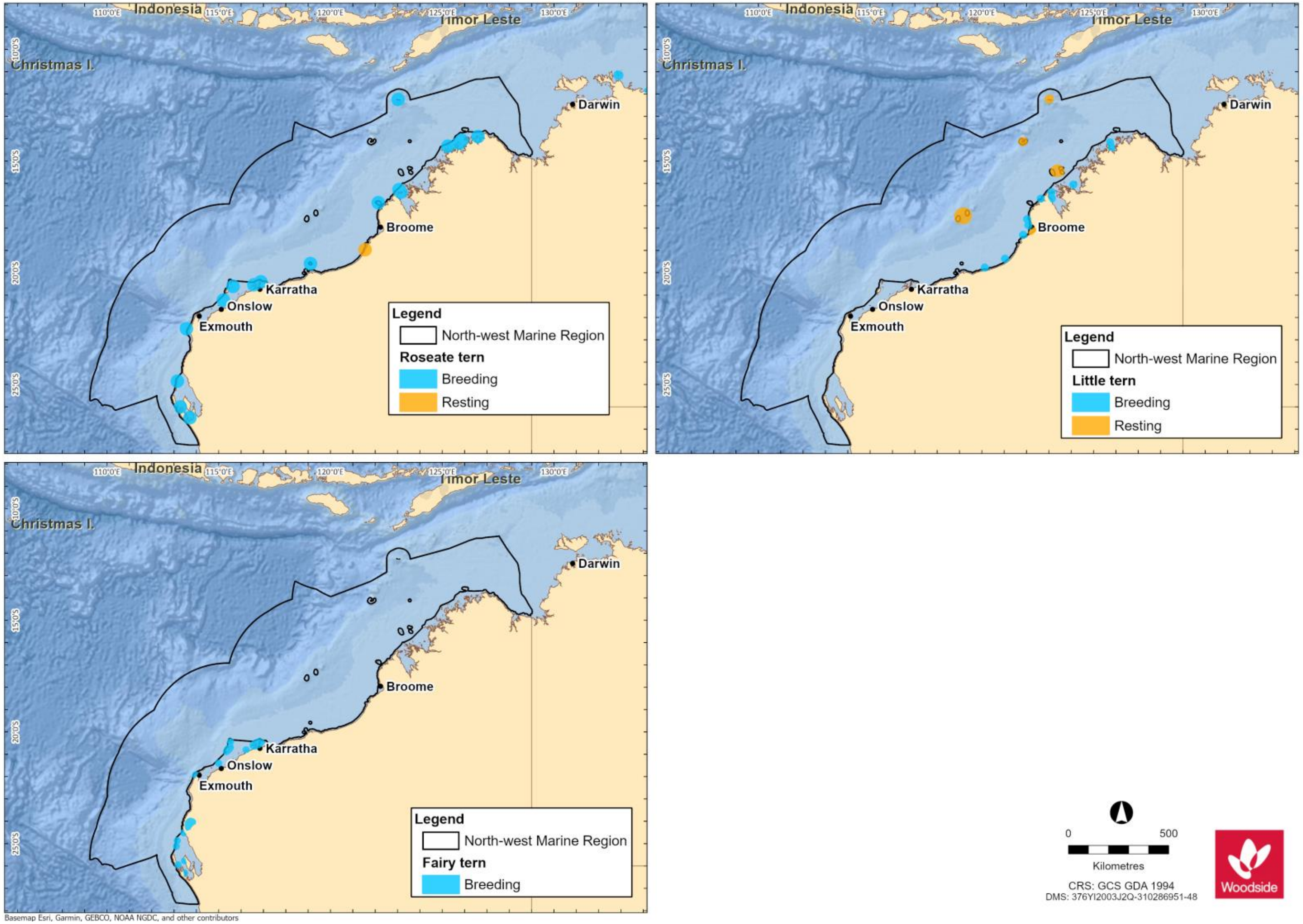

Figure 8-2 Tern species BIAs for the NWMR

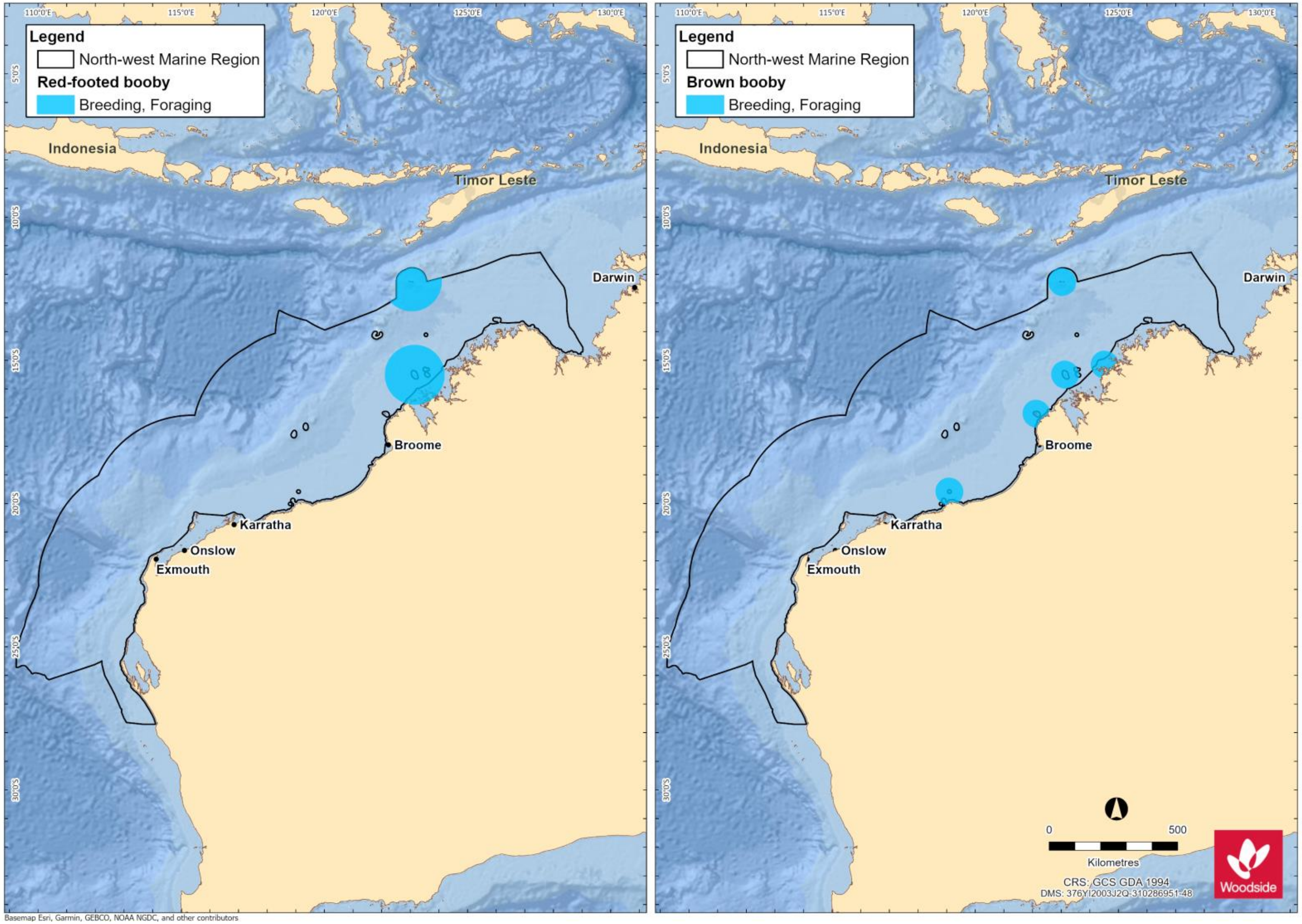

Figure 8-3 Red-footed and brown booby BIAs for the NWMR

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 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

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).

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**.

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

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).

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.

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.

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.*

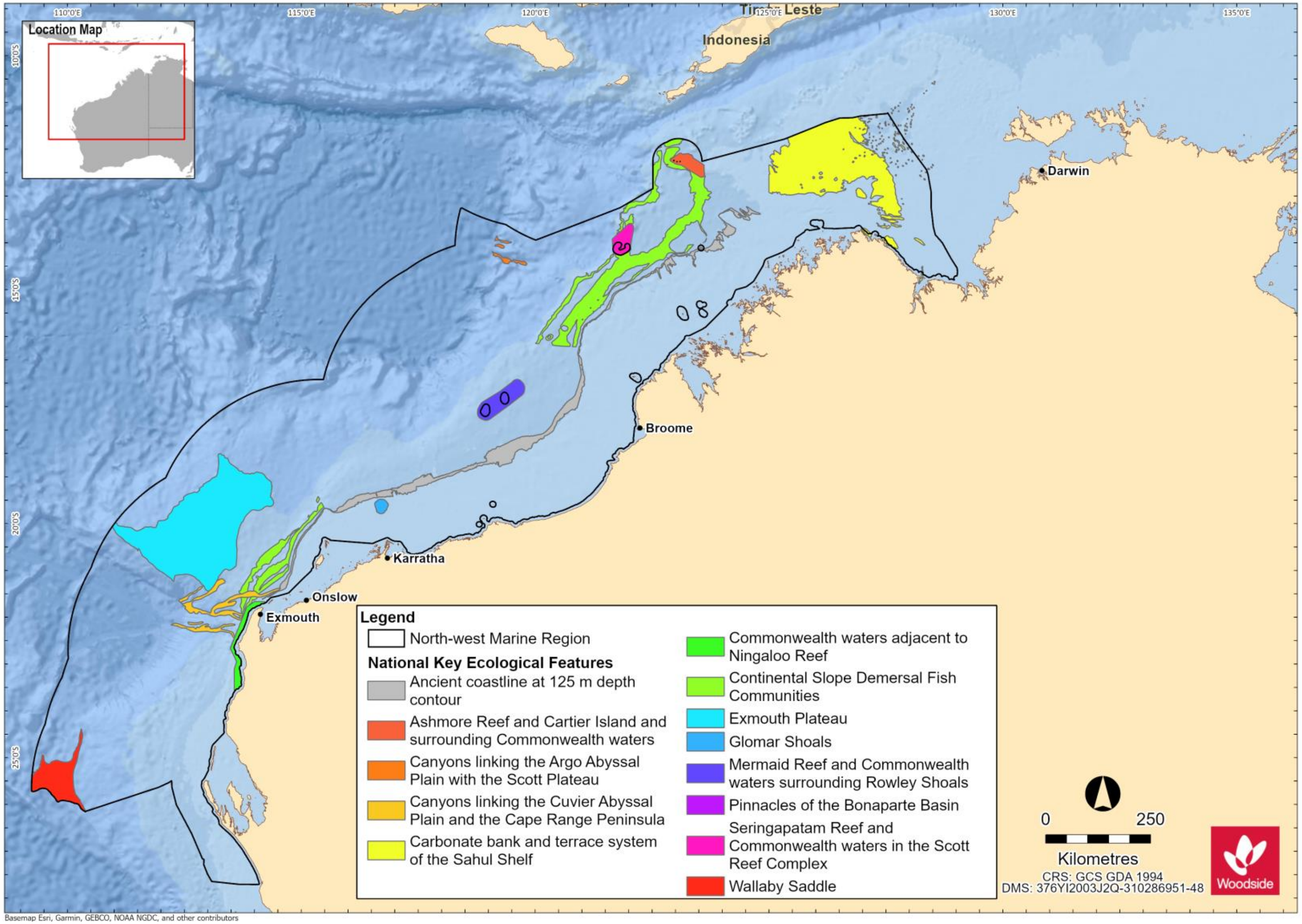

Figure 9-1 Key Ecological Features (KEFs) within the NWMR.

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.

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.

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

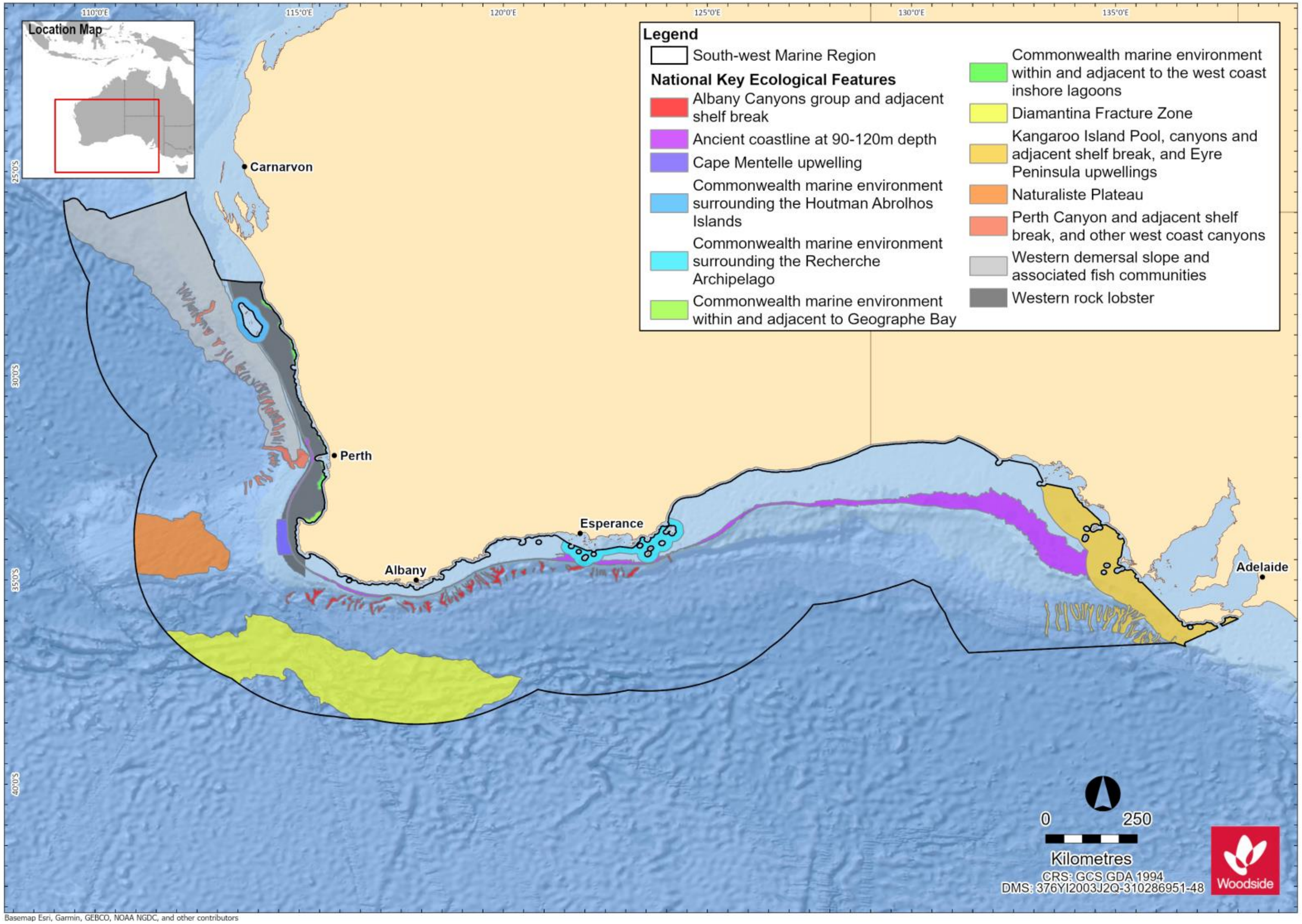

Figure 9-2. Key Ecological Features (KEFs) within the SWMR

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.

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.

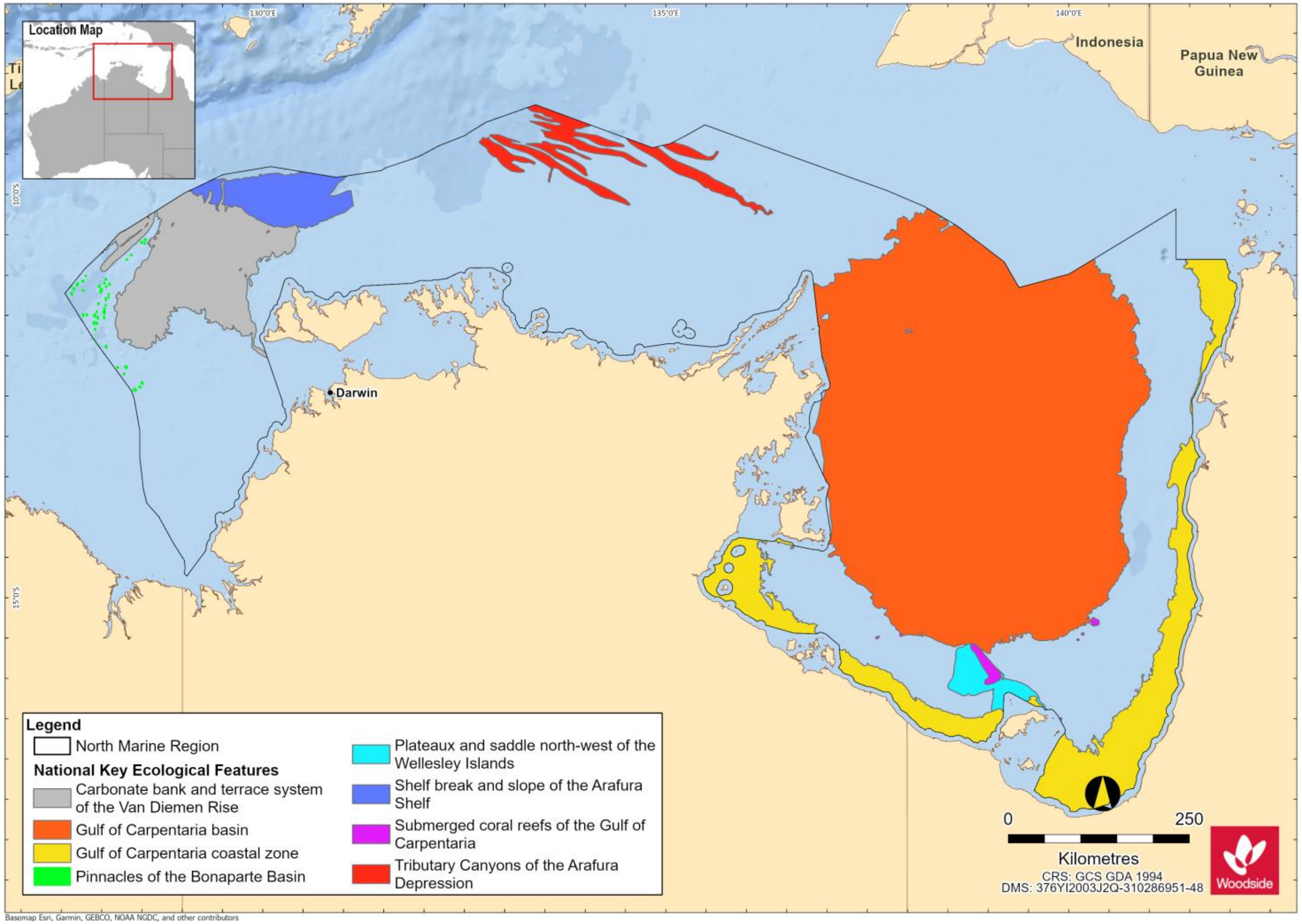

Figure 9-3. Key Ecological Features (KEFs) within the NMR

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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 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**).

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.

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.

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.

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.

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.

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

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.

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.

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

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

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

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).

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)

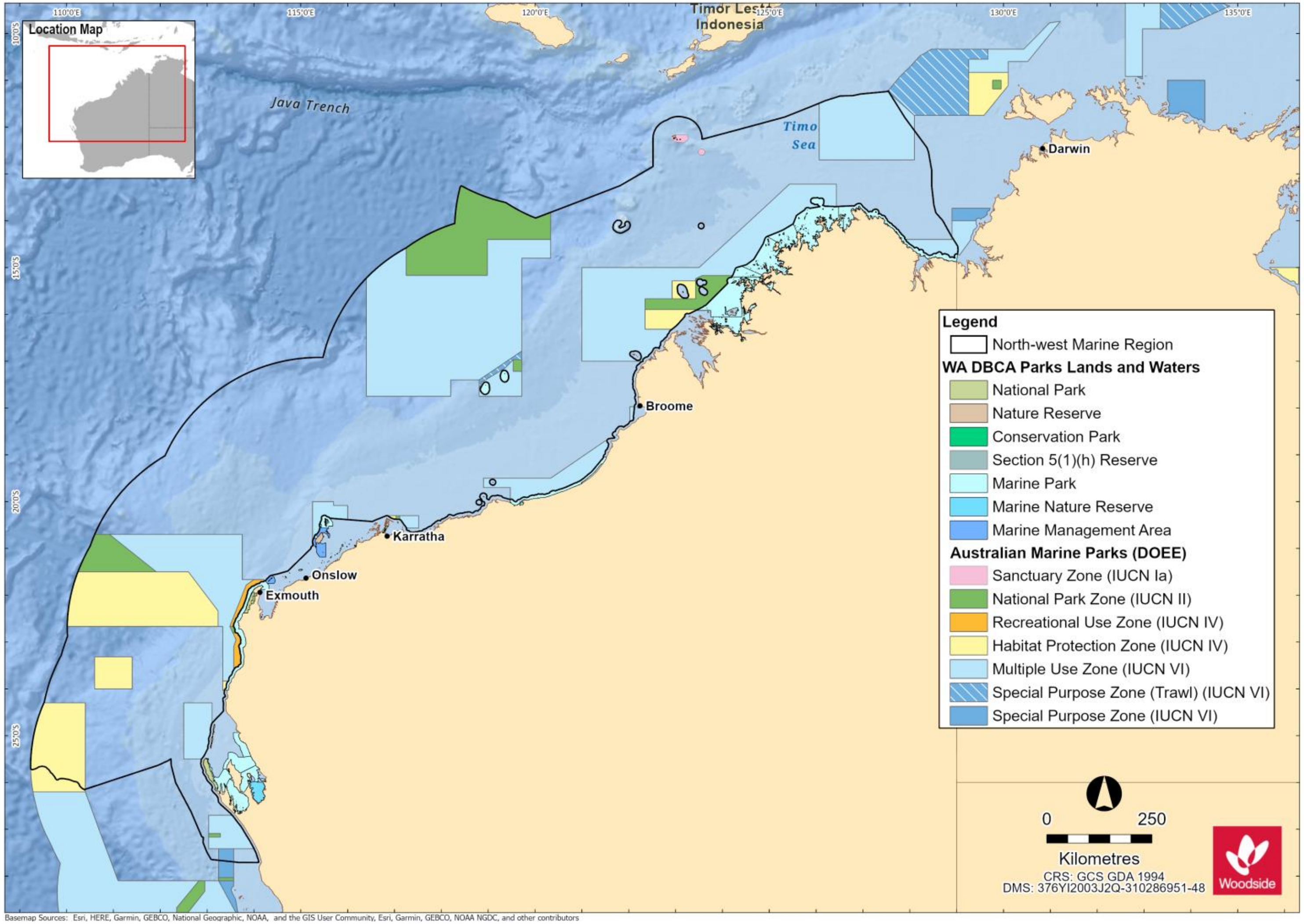

Figure 10-1 Commonwealth and State Marine Protected Areas for the NWMR

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

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.

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

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.

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

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

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)

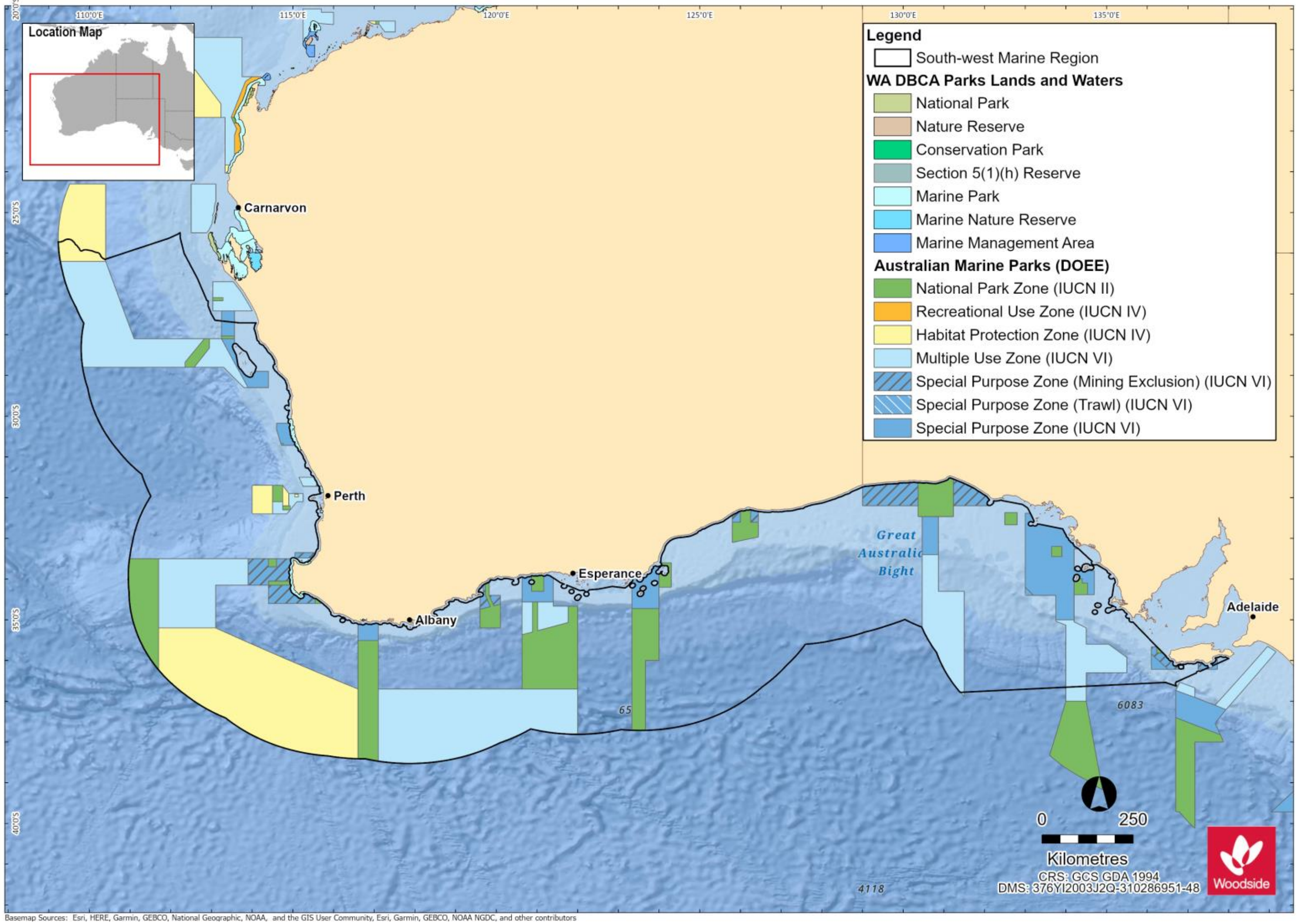

Figure 10-2. Commonwealth and State Marine Protected Areas for the SWMR

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.

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.

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

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)

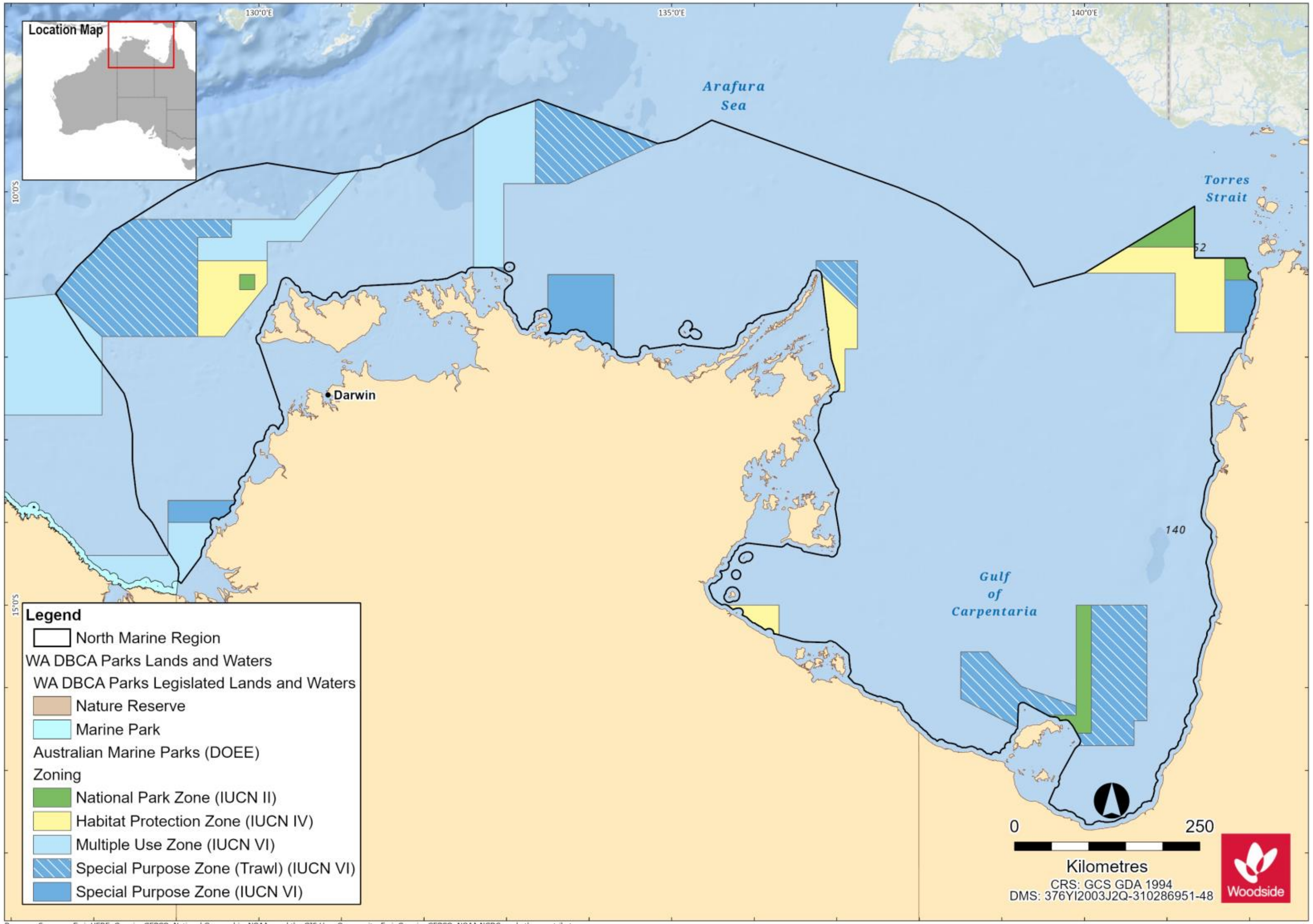

Figure 10-3. Commonwealth and State Marine Protected Areas within the NMR

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)*.

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**.

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						

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.

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).

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**.

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="4">Description</th></tr>
<tr><th>Browse</th><th>NWS/S</th><th>NW Cape</th></tr>
<tr><td colspan="8">Commonwealth Managed Fisheries</td></tr>
<tr><td rowspan="6">Southern Bluefin Tuna Fishery</td><td rowspan="6">✓</td><td rowspan="6">✓</td><td rowspan="6">✓</td><td>Management area</td><td colspan="3">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 colspan="2">Species targeted</td><td>Fishing methods</td><td>Fishing depth</td></tr>
<tr><td colspan="2">Southern bluefin tuna (Thunnus maccoyii)</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="3">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 et al., 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="3">Seven purse seine vessels, 20 longline vessels (Patterson et al., 2020).</td></tr>
<tr></tr>
<tr><td>Western Skipjack Tuna Fishery</td><td>✓</td><td>✓</td><td>✓</td><td>Management area</td><td colspan="3">The combined western and eastern skipjack tuna (Katsuwonus pelamis) 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>

Fishery	Woodside Activity Area			Description			
	Browse	NWS/S	NW Cape				
				Species targeted		**Fishing methods**	**Fishing depth**
				Western skipjack tuna (*Katsuwonus pelamis*)		Fishers use purse seine gear (about 98% of catch) and sometimes pole and line when fishing for skipjack tuna.	Western skipjack tuna is a pelagic species that can be found to depths of 260 m (AFMA, 2021b).
				Fishing effort:	The Skipjack Tuna Fishery (STF) has not been actively fished since the 2008-2009 fishing season (Patterson *et al*., 2020). The management arrangements for this fishery will be reviewed if active boats re-enter the fishery.		
				Active licences/vessels:	No active vessels operating since 2009.		
Western Tuna and Billfish Fishery	✓	✓	✓	**Management area**	The Western Tuna and Billfish Fishery (WTBF) extends to the Australian EEZ boundary in the Indian Ocean.		
				Species targeted		**Fishing methods**	**Fishing depth**
				Bigeye tuna (*Thunnus obesus*) Yellowfin tuna (*Thunnus albacares*) Swordfish (*Xiphias gladius*) Albacore (*Thunnus alalonga*) Striped marlin (*Kajikia audax*)		Fishers mainly use pelagic longline fishing gear to catch the targeted species. Minor line (including handline, troll, rod and reel) can also be used.	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).
				Fishing effort:	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.		
				Active licences/vessels:	Two pelagic longline vessels and two minor longline vessels (Patterson *et al*., 2020).		
Western Deepwater Trawl Fishery			✓	**Management area**	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).		

Fishery	Woodside Activity Area: Browse	Woodside Activity Area: NWS/S	Woodside Activity Area: NW Cape	Description		
				Species targeted	**Fishing methods**	**Fishing depth**
				More than 50 species, historically dominated by six commercial finfish species or species groups: Orange roughy (*Hoplostethus atlanticus*) Oreos (Oreosomatidae) Boarfish (Pentacerotidae) Eteline snapper (Lutjanidae: Etelinae) Apsiline snapper (Lutjanidae: Apsilinae) Sea bream (Lethrinidae)	Demersal trawl.	Water deeper than 200 m, stakeholder consultation has indicated that this may be to depths of 800 m.
				Fishing effort:	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 *et al*., 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 *et al*., 2020).	
				Active licences/vessels:	One active vessel in 2018-2019 (Patterson *et al.*, 2020).	
North-west Slope Trawl Fishery	✓	✓		**Management area**	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).	
				Species targeted	**Fishing methods**	**Fishing depth**
				Australian scampi (*Metanephrops australiensis*) and smaller quantities of velvet and Boschma's scampi (*M. velutinus* and *M. boschmai*) Mixed snappers have historically been an important component of the catch.	Demersal trawl.	Typically at depths of 350 to 600 m (Patterson *et al*., 2017), however stakeholder consultation has indicated that this may be to depths of 800 m.

<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></td><td></td><td></td><td></td><td>Fishing effort:</td><td colspan="2">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 et. al. 2020).
Fishing for scampi occurs over soft, muddy sediments or sandy habitats, using demersal trawl gear on the continental slope (Patterson et al., 2017).</td></tr>
<tr><td></td><td></td><td></td><td></td><td>Active licences/vessels:</td><td colspan="2">Four vessels (Patterson et. al., 2020).</td></tr>
<tr><td colspan="7">State Managed Fisheries</td></tr>
<tr><td>Pilbara Fish Trawl (Interim) Managed Fishery</td><td></td><td>✓</td><td></td><td>Management area</td><td colspan="2">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 et al., 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></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>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 et al., 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 et al., 2014, Newman et al. 2015). Stakeholders have advised that trawling can occur in depths of up to approximately 800 m.</td></tr>
<tr><td></td><td></td><td></td><td></td><td>Fishing effort:</td><td colspan="2">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>
</table>

Fishery	Woodside Activity Area: Browse	Woodside Activity Area: NWS/S	Woodside Activity Area: NW Cape	Description		
					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.	
				Active licences/vessels:	Two Pilbara Trawl (Interim) Managed Fishery vessels in 2017 (Newman *et al*., 2020a). Active vessels data are confidential as there were fewer than three vessels in the Pilbara Fish Trawl Interim Managed Fishery (Newman *et al*., 2020a).	
Pilbara Trap Managed Fishery		✓	✓	**Management area**	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.	
				Species targeted	**Fishing methods**	**Fishing depths**
				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.	Demersal fish traps.	Greatest effort in waters less than 50 m depth targeting high value species such as red emperor and goldband snapper.
				Fishing effort	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 *et al*., 2019).	

<table>
<tr><th rowspan="2">Fishery</th><th colspan="3">Woodside Activity Area</th><th colspan="3" rowspan="2">Description</th></tr>
<tr><th>Browse</th><th>NWS/S</th><th>NW Cape</th></tr>
<tr><td></td><td></td><td></td><td></td><td>Active licences/vessels</td><td colspan="2">In the 2019 season, there were six licences in the Pilbara Trap Managed Fishery, (Newman et al., 2020a). Active vessels data are confidential as there were fewer than three vessels in the Pilbara Trap Managed Fishery (Newman et al., 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="2">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>Species targeted</td><td>Fishing method</td><td>Fishing depths</td></tr>
<tr><td>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="2">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 et al., 2019).</td></tr>
</table>

<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></td><td></td><td></td><td></td><td>Active licences/vessels</td><td colspan="2">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).</td></tr>
<tr><td rowspan="5">Mackerel Managed Fishery</td><td rowspan="5">✓</td><td rowspan="5">✓</td><td rowspan="5">✓</td><td>Management area</td><td colspan="2">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).</td></tr>
<tr><td>Species targeted</td><td>Fishing methods</td><td>Fishing depth</td></tr>
<tr><td>Spanish mackerel (Scomberomorus commerson)
Grey mackerel (S. semifasciatus)
Other species from the genus Scomberomorus</td><td>Near-surface trawling gear.
Jig fishing.</td><td>Previous engagement with WAFIC suggests that the depth of fisheries may extend to 70 m.</td></tr>
<tr><td>Fishing effort:</td><td colspan="2">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.</td></tr>
<tr><td>Active licences/vessels:</td><td colspan="2">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).</td></tr>
<tr><td rowspan="2">Marine Aquarium Managed Fishery</td><td rowspan="2">✓</td><td rowspan="2">✓</td><td rowspan="2">✓</td><td>Management area</td><td colspan="2">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).</td></tr>
<tr><td>Species targeted</td><td>Fishing methods</td><td>Fishing depth</td></tr>
</table>

<table>
<tr><th rowspan="2">Fishery</th><th colspan="3">Woodside Activity Area</th><th rowspan="2" colspan="4">Description</th></tr>
<tr><th>Browse</th><th>NWS/S</th><th>NW Cape</th></tr>
<tr><td rowspan="3"></td><td rowspan="3"></td><td rowspan="3"></td><td rowspan="3"></td><td colspan="2">Finfish, hard coral, soft coral, tridacnid clams, syngnathids (seahorses and pipefish), other invertebrates (including molluscs, crustaceans, echinoderms etc.), algae, seagrasses and ‘live rock’.</td><td>The fishery is diver-based, which typically restricts effort to safe diving depths (less than 30 m).</td><td>Less than 30 m, as advised by WAFIC.</td></tr>
<tr><td>Fishing effort:</td><td colspan="3">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.</td></tr>
<tr><td>Active licences/vessels:</td><td colspan="3">Eleven licences were active in 2019 (Newman et al., 2020b).</td></tr>
<tr><td rowspan="5">Beche-de-mer Fishery</td><td rowspan="5">✓</td><td rowspan="5">✓</td><td rowspan="5">✓</td><td>Management area</td><td colspan="3">Fishing occurs in the northern half of WA from Exmouth Gulf to the NT border and is managed under Ministerial Exemptions.</td></tr>
<tr><td colspan="2">Species targeted</td><td>Fishing methods</td><td>Fishing depth</td></tr>
<tr><td colspan="2">The sea cucumber fishery targets two main species: sandfish (Holothuria scabra) and redfish (Actinopyga echinites).</td><td>Diving</td><td>The targeted species typically inhabit nearshore in shallow depths.</td></tr>
<tr><td>Fishing effort</td><td colspan="3">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</td></tr>
<tr><td>Active licences/vessels</td><td colspan="3">Six active licences in 2019 (Hart et al., 2019). Active vessels data is confidential as there were fewer than three vessels.</td></tr>
<tr><td rowspan="2">Onslow Prawn Managed Fishery</td><td rowspan="2"></td><td rowspan="2">✓</td><td rowspan="2"></td><td>Management area</td><td colspan="3">The Onslow Prawn Managed Fishery encompasses a portion of the continental shelf off the Pilbara.</td></tr>
<tr><td colspan="2">Species targeted</td><td>Fishing methods</td><td>Fishing depth</td></tr>
</table>

Fishery	Woodside Activity Area: Browse	Woodside Activity Area: NWS/S	Woodside Activity Area: NW Cape	Description		
				The fishery targets: Western king prawns (*Penaeus esculentus*) Brown tiger prawns (*Penaeus esculentus*) Blue endeavour prawns (*Metapenaeus endeavouri*	Low opening, otter prawn trawl systems.	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 *et al*., 2015).
				Fishing effort:	The total landings for the Onslow Prawn Managed Fishery in 2018 were less than 60 t below the target catch range (Kangas *et al*., 2020a).	
				Active licences/vessels:	One vessel (Kangas *et al*., 2020a).	
Pearl Oyster Managed Fishery	✓	✓	✓	**Management area**	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.	
				Species targeted	**Fishing methods**	**Fishing depth**
				Pearl oysters (*Pinctada maxima*).	Drift diving.	Fishing effort is mostly focussed in shallow coastal waters (10-15 m depth), with a maximum depth of 35 m (Lulofs *et al.* 2002).
				Fishing effort:	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).	
				Active licences/vessels:	15,637 diver hours (Hart *et al.*, 2020a).	
		✓	✓	**Management area**	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	

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,		

<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">Specimen Shell Managed Fishery</td><td rowspan="5"></td><td rowspan="5"></td><td rowspan="5"></td><td></td><td colspan="2">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.</td></tr>
<tr><td>Species targeted</td><td>Fishing methods</td><td>Fishing depth</td></tr>
<tr><td>The Specimen Shell Managed Fishery targets the collection of specimen shells for display, collection, cataloguing and sale.</td><td>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).</td><td>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.</td></tr>
<tr><td>Fishing effort:</td><td colspan="2">Information not available.</td></tr>
<tr><td>Active licences/vessels:</td><td colspan="2">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).</td></tr>
<tr><td rowspan="3">West Australian Abalone Fishery</td><td rowspan="3">✓</td><td rowspan="3">✓</td><td rowspan="3">✓</td><td>Management area</td><td colspan="2">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.</td></tr>
<tr><td>Species targeted</td><td>Fishing methods</td><td>Fishing depth</td></tr>
<tr><td>Greenlip abalone (Haliotis laevigata)
Brownlip abalone (Haliotis conicopora)
Roe’s abalone (Haliotis roei)</td><td>Divers.</td><td>Distribution to 5 m depth for Roe’s abalone and 40 m depth for greenlip / brownlip abalone (DOF, 2011).</td></tr>
</table>

<table>
<tr><th rowspan="2">Fishery</th><th colspan="3">Woodside Activity Area</th><th rowspan="2" colspan="4">Description</th></tr>
<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 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 et al., 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 (Chaceon albus)
Giant (king) crab (Pseudocarcinus gigas)
Champagne (spiny) crabs (Hypothalassia acerba)</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>

[5] https://www.wafic.org.au/fishery/roes-abalone-fishery/
[6] https://www.wafic.org.au/fishery/west-coast-deep-sea-crustacean-fishery/

<table>
<tr><th rowspan="2">Fishery</th><th colspan="3">Woodside Activity Area</th><th colspan="4" rowspan="2">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="3">The Abrolhos Islands and Mid-West Trawl Fishery (AIMWTMF) operates around the Abrolhos Islands within the SWMR.</td></tr>
<tr><td colspan="2">Species targeted</td><td>Fishing methods</td><td>Fishing depth</td></tr>
<tr><td colspan="2">Saucer scallops (Ylistrum balloti, formerly Amusium balloti)</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 et al., 2009).</td></tr>
<tr><td>Fishing effort:</td><td colspan="3">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 et al., 2020b). The fishery was closed between 2011 and 2016.</td></tr>
<tr><td>Active licences/vessels:</td><td colspan="3">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="3">The Broome Prawn Managed Fishery (BPMF) operates off Broome and forms part of the North Coast Prawn Fishery.</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 (Penaeus latisulcatus)
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="3">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 et al., 2020a).</td></tr>
</table>

<table>
<tr><th rowspan="2">Fishery</th><th colspan="3">Woodside Activity Area</th><th colspan="3" rowspan="2">Description</th></tr>
<tr><th>Browse</th><th>NWS/S</th><th>NW Cape</th></tr>
<tr><td></td><td></td><td></td><td></td><td>Active licences/vessels:</td><td colspan="2">Two vessels conducting fishing trial operated in 2018 (Kangas et al., 2020a).</td></tr>
<tr><td rowspan="5">Exmouth Gulf Prawn Managed Fishery</td><td rowspan="5"></td><td rowspan="5"></td><td rowspan="5">✓</td><td>Management area</td><td colspan="2">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 km², with only half of this area being trawled (Fletcher and Santoro, 2015).</td></tr>
<tr><td>Species targeted</td><td>Fishing methods</td><td>Fishing depth</td></tr>
<tr><td>Western king prawn (Penaeus latisulcatus)
Brown tiger prawn (Penaeus esculentus)
Blue endeavour prawn (Metapenaeus endeavouri)
Banana prawn (Penaeus merguinensis)</td><td>Trawl.</td><td>Information not available.</td></tr>
<tr><td>Fishing effort:</td><td colspan="2">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.</td></tr>
<tr><td>Active licences/vessels:</td><td colspan="2">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]).</td></tr>
<tr><td rowspan="2">Gascoyne Demersal Scalefish Managed Fishery</td><td rowspan="2"></td><td rowspan="2"></td><td rowspan="2">✓</td><td>Management area</td><td colspan="2">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]).</td></tr>
<tr><td>Species targeted</td><td>Fishing methods</td><td>Fishing depth</td></tr>
</table>

7 https://www.wafic.org.au/fishery/exmouth-gulf-prawn-fishery/
8 https://www.wafic.org.au/fishery/gascoyne-demersal-scalefish-fishery/

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**

<table>
<tr><th rowspan="2">Fishery</th><th colspan="3">Woodside Activity Area</th><th rowspan="2" colspan="4">Description</th></tr>
<tr><th>Browse</th><th>NWS/S</th><th>NW Cape</th></tr>
<tr><td rowspan="3"></td><td rowspan="3"></td><td rowspan="3"></td><td rowspan="3"></td><td colspan="2">Banana prawn (Penaeus merguiensis)
Western king prawn (Penaeus latisulcatus)
Brown tiger prawn (Penaeus esculentus)
Blue endeavour prawn (Metapenaeus endeavouri)</td><td>Trawl.</td><td>Information not available.</td></tr>
<tr><td>Fishing effort:</td><td colspan="3">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).</td></tr>
<tr><td>Active licences/vessels:</td><td colspan="3">The precise number of vessels is unreported, though low effort produced a catch of 17 t in 2016 (Kangas et al., 2018).</td></tr>
<tr><td rowspan="3">Northern Demersal Scalefish Managed Fishery</td><td rowspan="3">✓</td><td rowspan="3"></td><td rowspan="3"></td><td>Management area</td><td colspan="3">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).</td></tr>
<tr><td colspan="2">Species targeted</td><td>Fishing methods</td><td>Fishing depth</td></tr>
<tr><td colspan="2">Goldband snapper (Pristipomoides multidens)
Blue-spotted emperor (Lethrinus punctulantus)
Red emperor (Lutjanus sebae)
Rankin cod (Epinephelus multinotatus)</td><td>Line fishing, handline, dropline and fish trap fishing.</td><td>Information not available.</td></tr>
</table>

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.

Fishery	Woodside Activity Area: Browse	Woodside Activity Area: NWS/S	Woodside Activity Area: NW Cape	Description		
				Fishing effort:	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]).	
				Active licences/vessels:	Six vessels operated employing around 12 fishers (Gaughan and Santoro, 2018).	
Shark Bay Crab Managed Fishery				**Management area**	The Shark Bay Crab Managed Fishery operates within the NWMR.	
				Species targeted	**Fishing methods**	**Fishing depth**
				Blue swimmer crab (*Portunus armatus*)	Trap and trawl.	Information not available.
				Fishing effort:	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 *et al.*, 2017).	
				Active licences/vessels:	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]).	
Shark Bay Prawn and Scallop Managed Fishery				**Management area**	The Shark Bay Prawn Managed Fishery is the highest producing WA fishery for prawns.	
				Species targeted	**Fishing methods**	**Fishing depth**
				Western king prawn (*Penaeus latisulcatus*) Brown tiger prawn (*Penaeus esculentus*)	Low-opening otter trawls.	Information not available.

[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/

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).	

Fishery	Woodside Activity Area			Description		
	Browse	NWS/S	NW Cape			
South Coast Purse Seine Managed Fishery				**Species targeted**	**Fishing methods**	**Fishing depth**
				Small pelagic finfish such as pilchards and yellowtail scad using purse seine nets from vessels. Sandy sprat (*Hyperlophus vittatus*) Blue sprat (*Spratelloides robustus*)	Purse seine.	Information not available.
				Fishing effort:	In the 2017/18 season the total catch effort was 2,168 t (Norriss and Blazeski, 2020).	
				Active licences/vessels:	Nine active vessels in 2017/18 (Norriss and Blazeski, 2020).	
South-west Trawl Managed Fishery	-	-	-	**Management area**	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).	
				Species targeted	**Fishing methods**	**Fishing depth**
				Scallops (*Ylistrum balloti,* formerly *Amusium balloti*) and associated by-products Western king prawn (*Penaeus latisulcatus*) In years of low scallop catches licencees may use other trawl gear to target fin-fish species.	Trawl.	Information not available.
				Fishing effort:	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).	
				Active licences/vessels:	Only one boat fished in 2018 for a total of 5 boat days for minimal catch (Fairclough and Walters, 2018).	

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<tr><th>Browse</th><th>NWS/S</th><th>NW Cape</th></tr>
<tr><td rowspan="5">The South Coast Salmon Managed Fishery</td><td rowspan="5">-</td><td rowspan="5">-</td><td rowspan="5">-</td><td>Management area</td><td colspan="3">The South Coast Salmon Managed Fishery is one of two fisheries operating in the South Coast Bioregion that target nearshore and estuarine finfish.</td></tr>
<tr><td colspan="2">Species targeted</td><td>Fishing methods</td><td>Fishing depth</td></tr>
<tr><td colspan="2">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)</td><td>Beach seines, haul nets and gill nets.</td><td>Information not available.</td></tr>
<tr><td>Fishing effort:</td><td colspan="3">The total catch for 2018 was 243 t (Duffy and Blay, 2020b).</td></tr>
<tr><td>Active licences/vessels:</td><td colspan="3">Number of vessels is unknown; however, 12 commercial fishers were employed in 2018 (Duffy and Blay, 2020b).</td></tr>
<tr><td rowspan="4">West Coast Beach Bait Managed Fishery</td><td rowspan="4">-</td><td rowspan="4">-</td><td rowspan="4">-</td><td>Management area</td><td colspan="3">Primarily active in the Bunbury areas in the SWMR.</td></tr>
<tr><td colspan="2">Species targeted</td><td>Fishing methods</td><td>Fishing depth</td></tr>
<tr><td colspan="2">Whitebait</td><td>Beach-based haul nets.</td><td>Information not available.</td></tr>
<tr><td>Fishing effort:</td><td colspan="3">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).</td></tr>
</table>

<table>
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<tr><th>Browse</th><th>NWS/S</th><th>NW Cape</th></tr>
<tr><td></td><td></td><td></td><td></td><td>Active licences/vessels:</td><td colspan="2">Number of vessels is unknown; however, only one license was issued (DPIRD, 2019).</td></tr>
<tr><td rowspan="5">West Coast Demersal Gillnet and Demersal Longline (Interim) Managed Fishery</td><td rowspan="5">-</td><td rowspan="5">-</td><td rowspan="5">-</td><td>Management area</td><td colspan="2">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).</td></tr>
<tr><td>Species targeted</td><td>Fishing methods</td><td>Fishing depth</td></tr>
<tr><td>Gummy shark (Mustelus antarcticus)
Dusky shark (Carcharhinus obscurus)
Whiskery shark (Furgaleus macki)
Sandbar shark (C. plumbeus)</td><td>Gillnet and longline.</td><td>Information not available.</td></tr>
<tr><td>Fishing effort:</td><td colspan="2">Catch estimated annual value of the fishery was $0.2 million for 2017 to 2018 (Braccini and Blay, 2020).</td></tr>
<tr><td>Active licences/vessels:</td><td colspan="2">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.</td></tr>
<tr><td rowspan="3">West Coast Demersal Scalefish Fishery</td><td rowspan="3">-</td><td rowspan="3">-</td><td rowspan="3">-</td><td>Management area</td><td colspan="2">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.</td></tr>
<tr><td>Species targeted</td><td>Fishing methods</td><td>Fishing depth</td></tr>
<tr><td>Baldchin groper (Choerodon rubescens)
Dhufish (Glaucosoma hebraicum)
Pink snapper (Pagrus auratus)</td><td>Lines.</td><td>Inshore species – 20 to 250 m water depth.</td></tr>
</table>

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.	

Fishery	Woodside Activity Area			Description			
	Browse	NWS/S	NW Cape				
				Species targeted		**Fishing methods**	**Fishing depth**
				Western rock lobster (*Panulirus cygnus)*		Baited pots.	Less than 20 m.
				Fishing effort:	In 2018, 234 vessels reported a total catch of 6400 t in 2017 (de Lestang *et al*., 2018). In 2016, 226 vessels reported a total catch of 6,086 t (Gaughan and Santoro, 2018).		
				Active licences/vessels:	234 vessels operated in 2017 and 233 vessels operated in 2018 (Gaughan and Santoro, 2018).		

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 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.

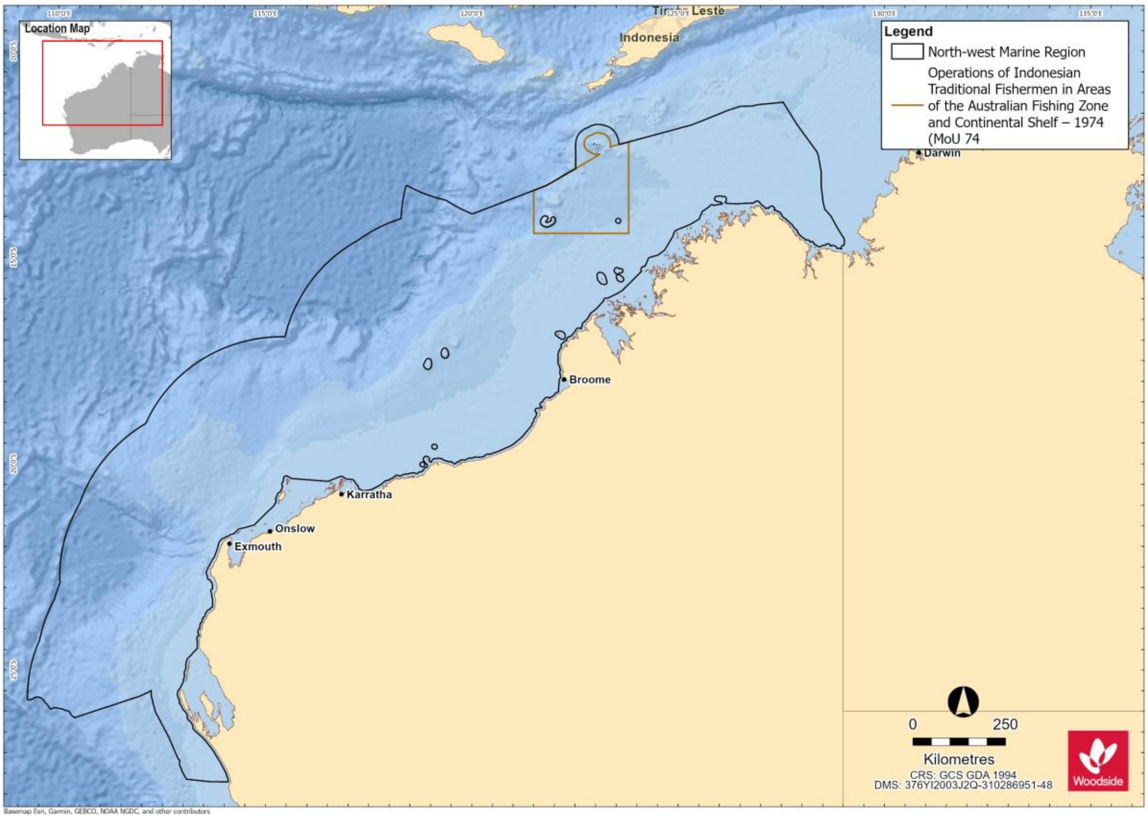

Figure 11-1 MOU 74 Box. Operations of Indonesian Traditional Fishermen in Areas of the Australian Fishing Zone and Continental Shelf – 1974

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).

[11] https://www.gdc.wa.gov.au/industry-profiles/tourism/

[12] https://www.pdc.wa.gov.au/our-focus/strategicinitiatives/tourism

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

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.

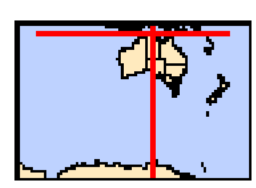
Information on the coverage of this report and qualifications on data supporting this report are contained in the caveat at the end of the report.

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

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:	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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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.

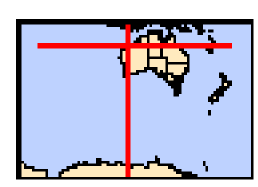
Information on the coverage of this report and qualifications on data supporting this report are contained in the caveat at the end of the report.

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

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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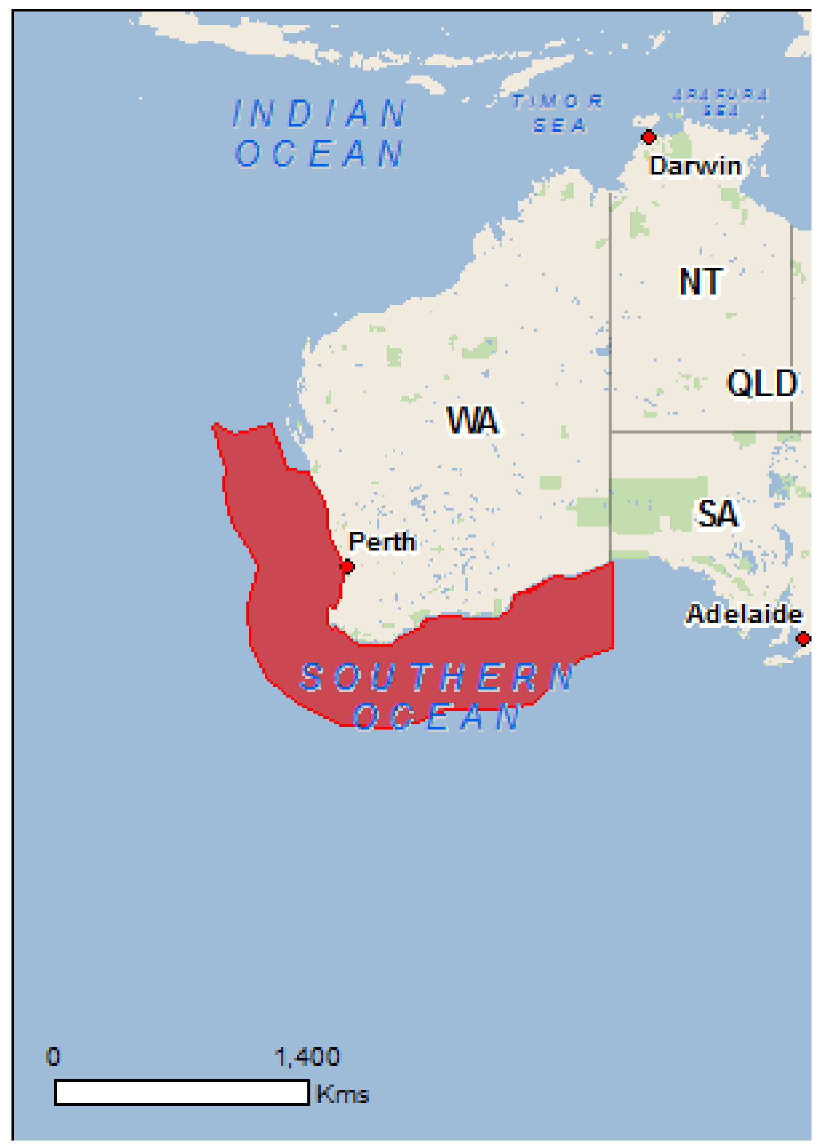
EPBC Act Protected Matters Report

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.

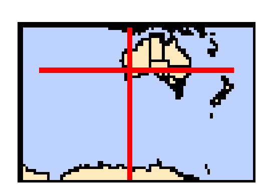
Information on the coverage of this report and qualifications on data supporting this report are contained in the caveat at the end of the report.

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



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

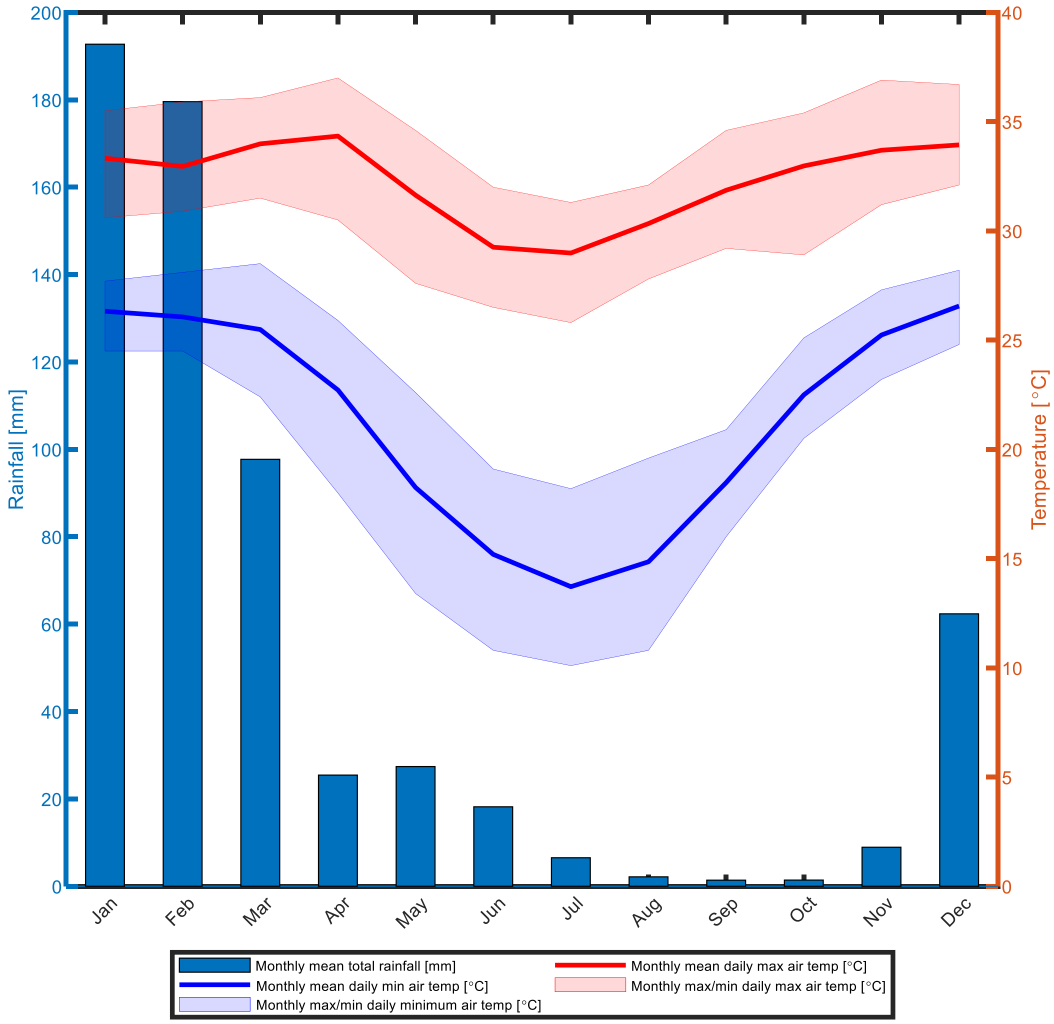
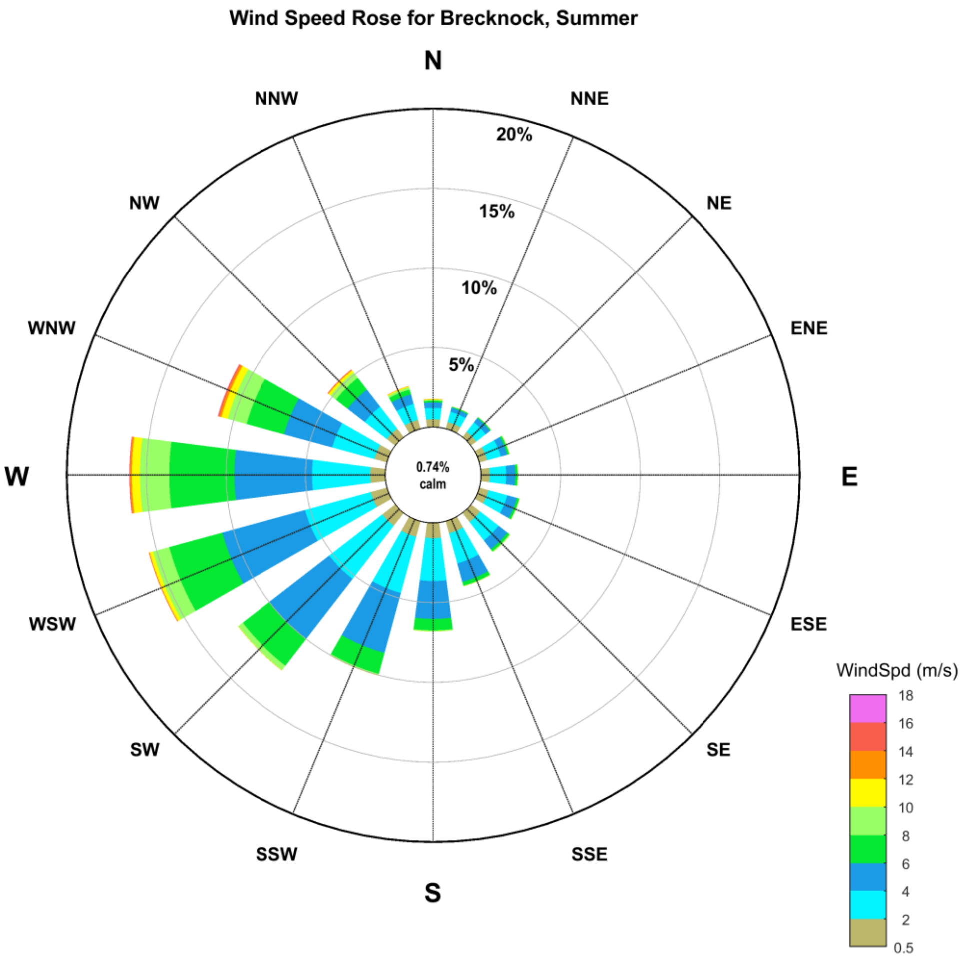


Figure 1. Monthly average total rainfall [mm] and air temperature [°C], calculated based on observations at the Broome Airport weather station from 1939-2020 (Bureau of Meteorology 2020). Bars show the monthly average total rainfall values, and thick blue and red lines denote monthly average daily minimum and maximum air temperatures, respectively. Shaded blue and red areas denote monthly recorded extremes of daily minimum and maximum air temperature, respectively.

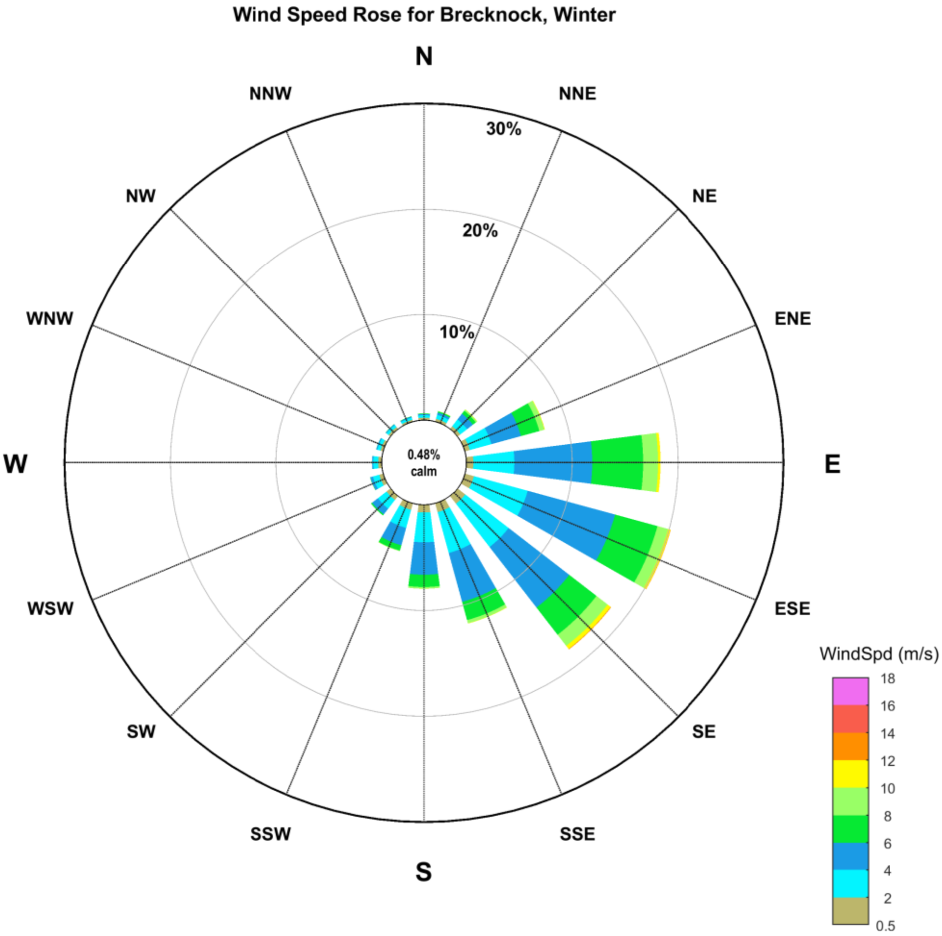


Data Information:
Project: Browse
Location: Brecknock [121.6500°E, 14.5300°S]
Data Period: Summer (01-Jan-1979 to 01-Jan-2019)
Data Source: Modelled Hindcast
Record Elevation: 10 m AMSL
Local Water Depth (m): 560
Data Summary: Summer
Number of Records: 164812
Missing Data (%): 5.80
Calm (% < 0.50m/s): 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).



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

Woodside

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).

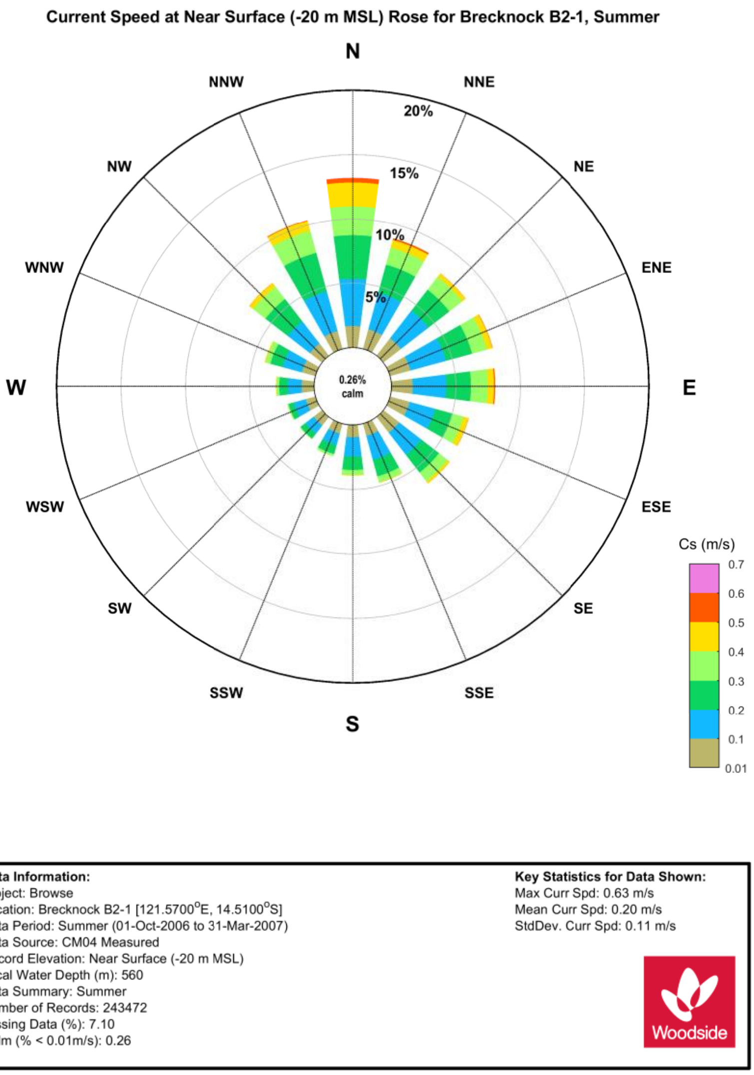
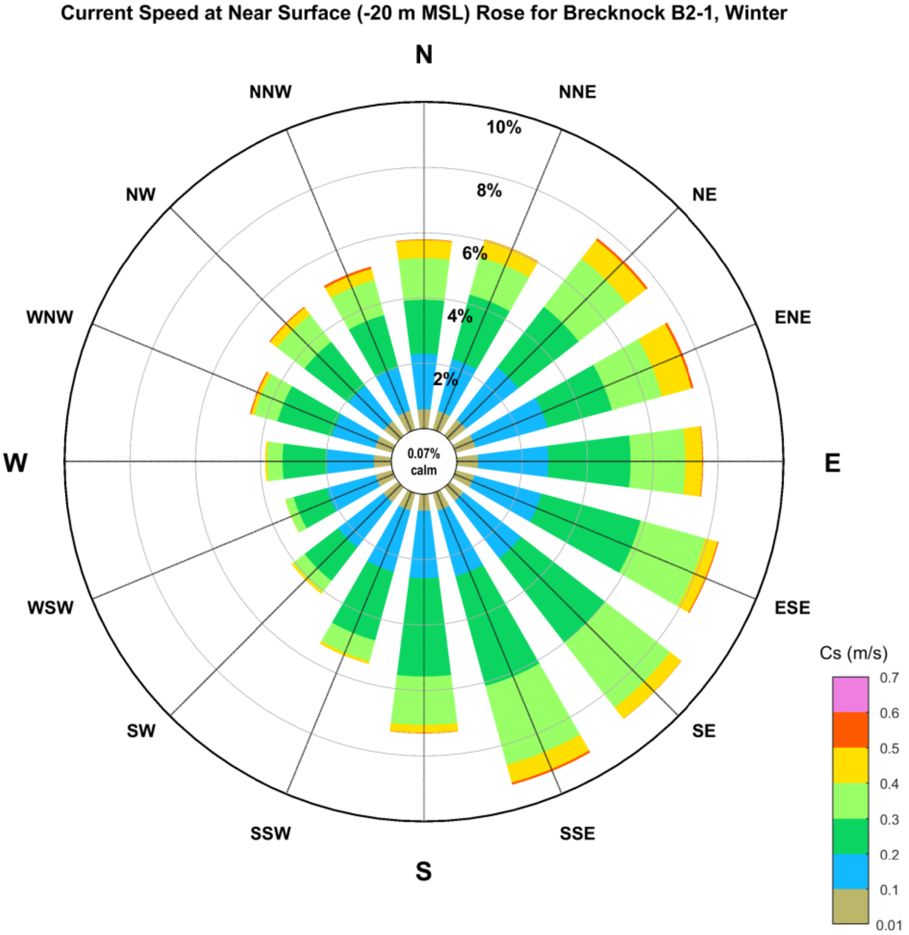


Figure 4. Summer (Nov-Apr) near surface combined frequency of 1-minute mean current speed and direction (towards) measured at Brecknock B2-1 location (cyclones removed) (RPS Metocean Ltd. 2008).



Data Information:
Project: Browse
Location: Brecknock B2-1 [121.5700^{o}E, 14.5100^{o}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

Woodside

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).

North-west Shelf/Scarborough

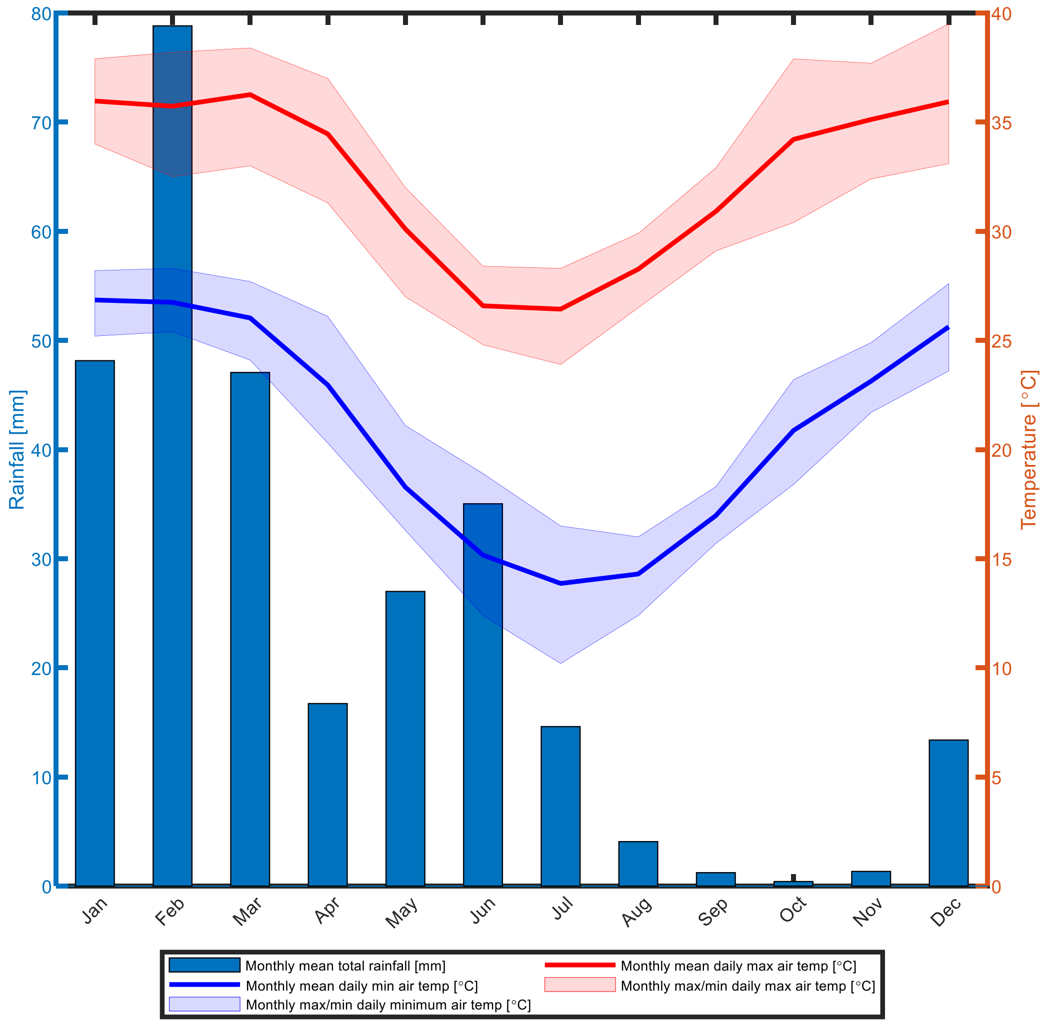


Figure 1. Monthly average total rainfall [mm] and air temperature [°C], calculated based on observations at the Karratha Aero weather station from 1972-2020 and 1993-2020 respectively (Bureau of Meteorology 2020). Bars show the monthly average total rainfall values, and thick blue and red lines denote 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.

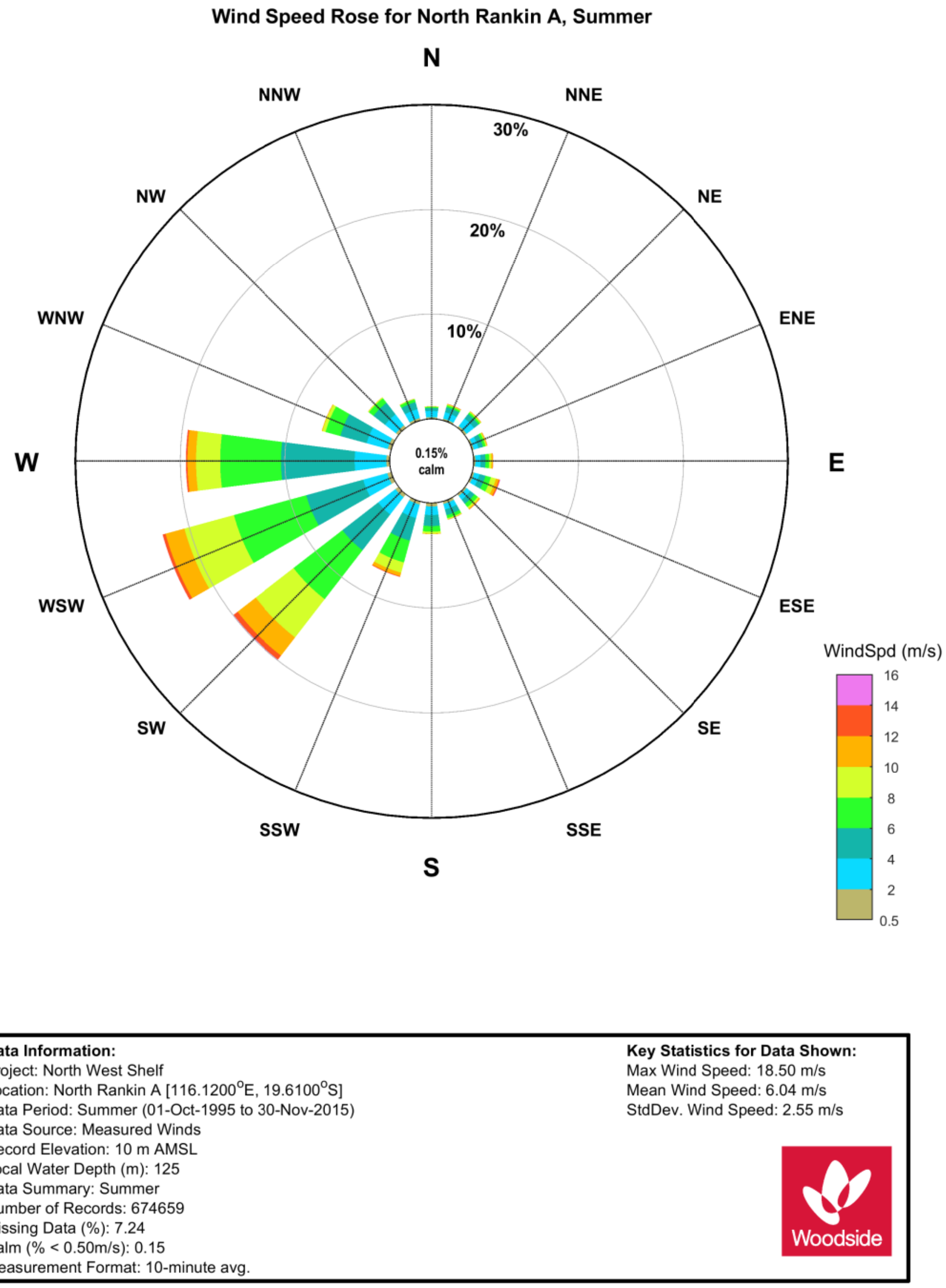
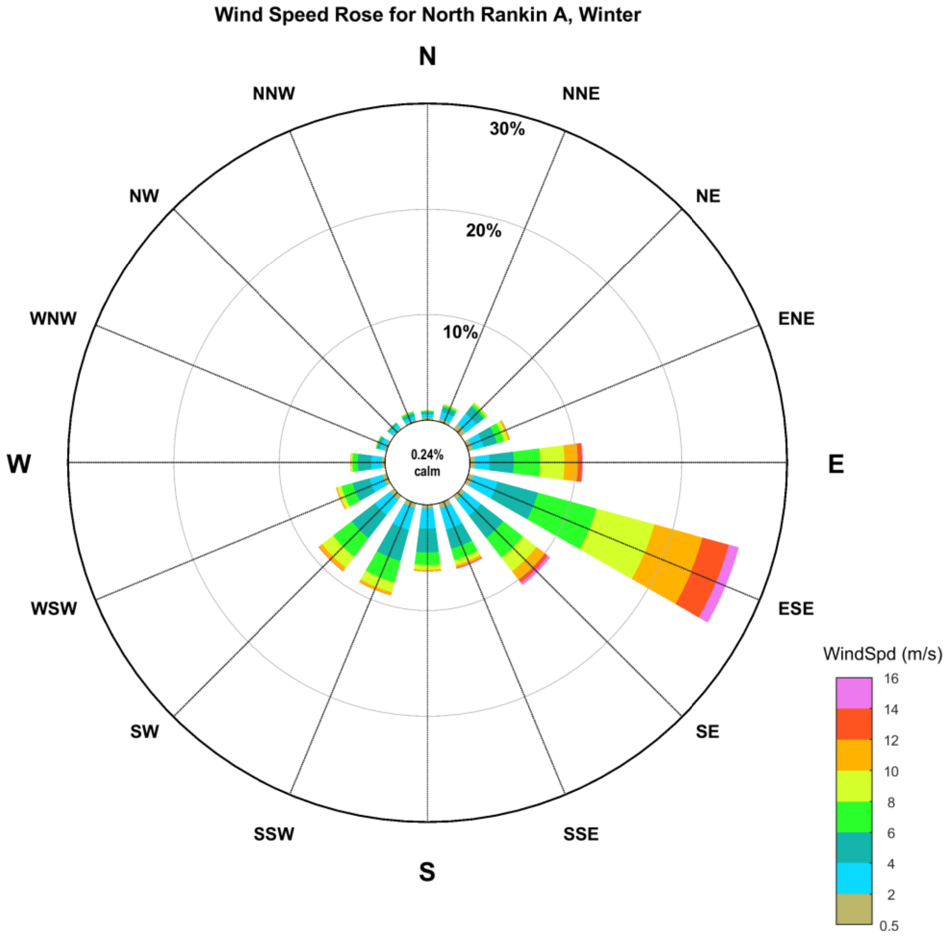


Figure 2. Summer distributions of 10-minute average wind speeds by 22.5° directional sectors at the North Rankin A site (WEL, 2015). Note tropical cyclone events were not included in this distribution. Winds at North Rankin A in summer are characterised by W to SW driven by the North West Monsoon (RPS, 2016).



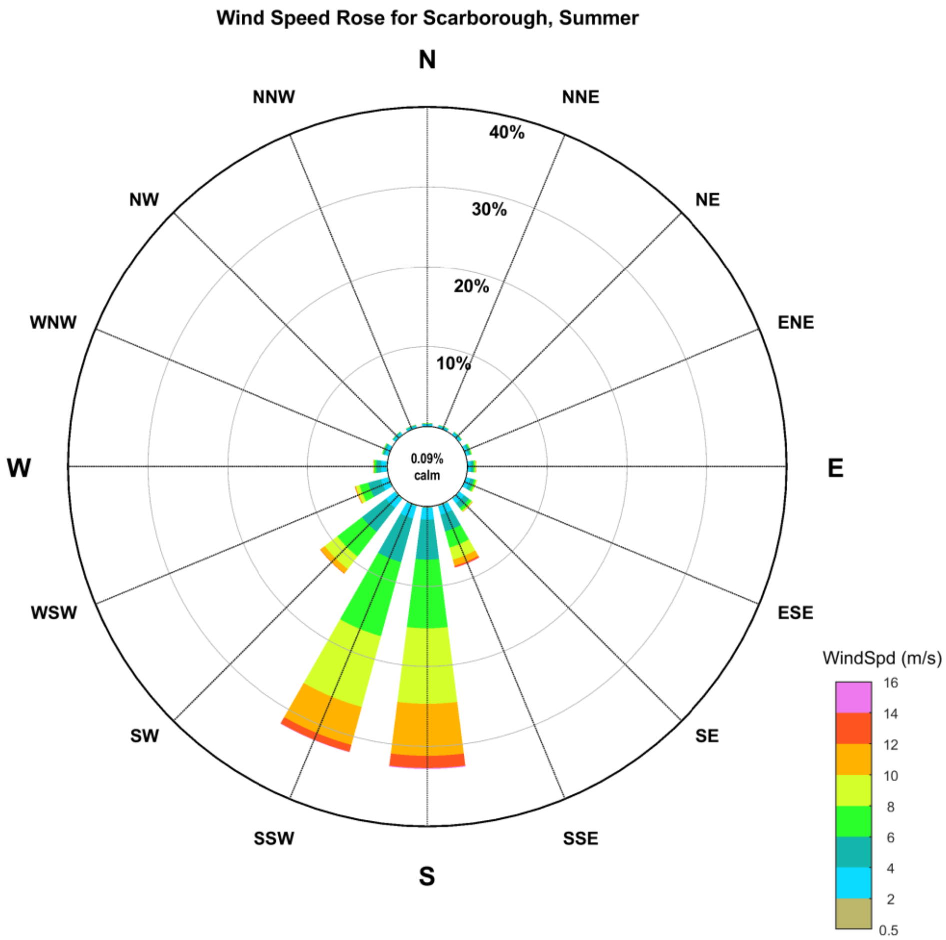
Data Information:
Project: North West Shelf
Location: North Rankin A [116.1200°E, 19.6100°S]
Data Period: Winter (22-Jun-1995 to 30-Sep-2015)
Data Source: Measured Winds
Record Elevation: 10 m AMSL
Local Water Depth (m): 125
Data Summary: Winter
Number of Records: 673213
Missing Data (%): 4.43
Calm (% < 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).

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

Woodside

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.

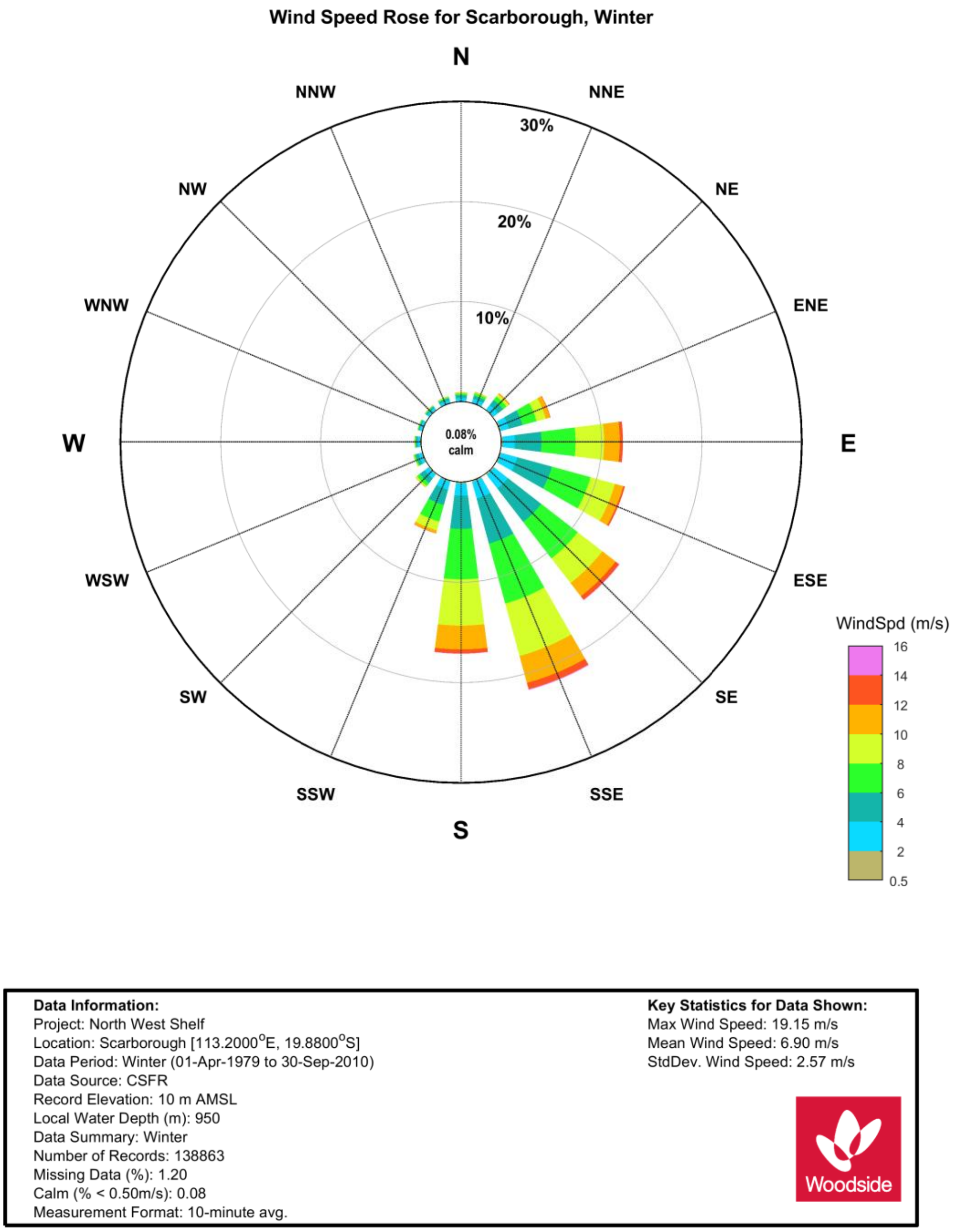
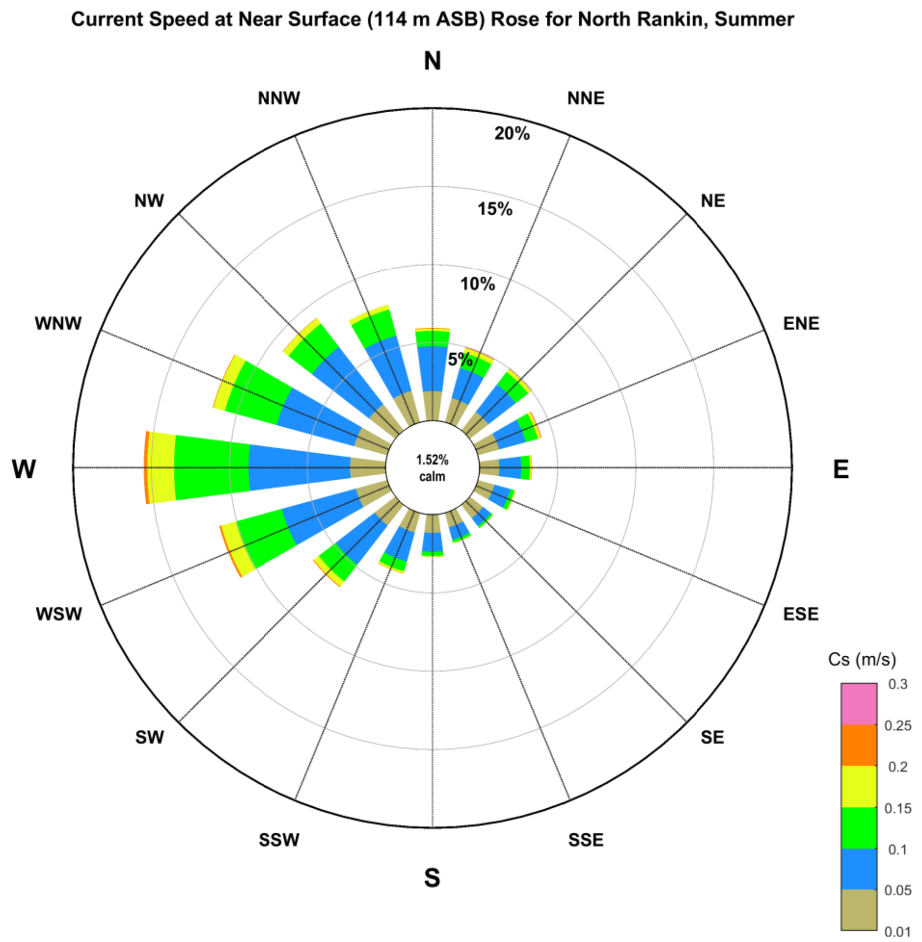


Figure 5. Winter distributions of wind speeds (10-minute at 10 m ASL) by 22.5° directional sectors at the Scarborough site (WEL, 2018). Note tropical cyclone events were not included in this distribution. Winds at Scarborough in winter are predominantly from the S to E driven by the South East Trade Winds over Australia (RPS, 2016).

North-west Shelf

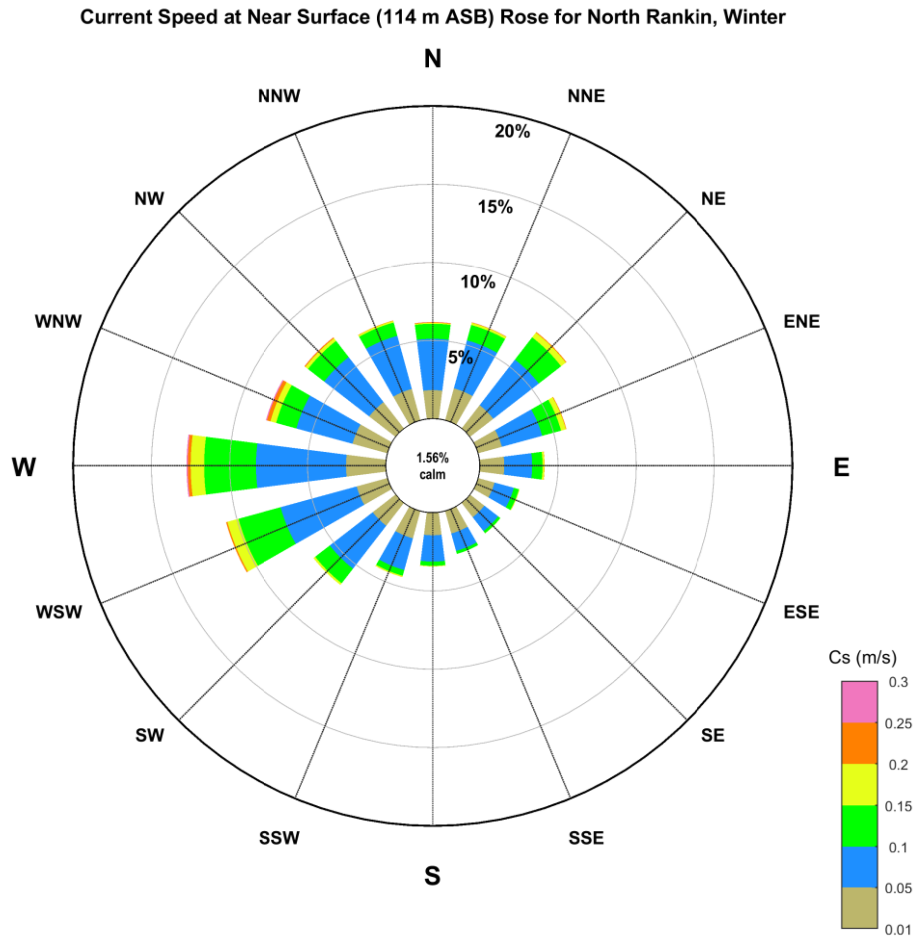


Data Information:
Project: North West Shelf
Location: North Rankin [116.1400°E, 19.5800°S]
Data Period: Summer (01-Oct-2004 to 31-Mar-2009)
Data Source: Measured Data
Record Elevation: Near Surface (114 m ASB)
Local Water Depth (m): 124.5
Data Summary: Summer
Number of Records: 496705
Missing Data (%): 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

Woodside

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).

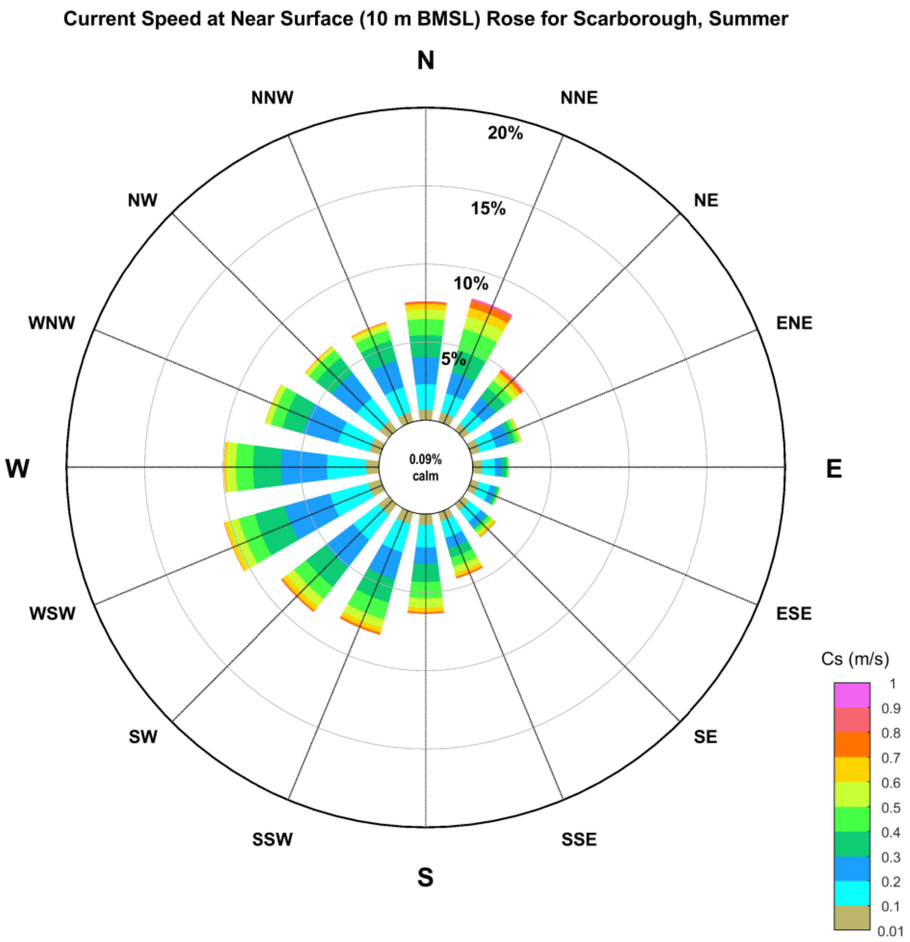


Data Information:
Project: North West Shelf
Location: North Rankin [116.1400°E, 19.5800°S]
Data Period: Winter (21-Sep-2004 to 08-May-2009)
Data Source: Measured Data
Record Elevation: Near Surface (114 m ASB)
Local Water Depth (m): 124.5
Data Summary: Winter
Number of Records: 337723
Missing Data (%): 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

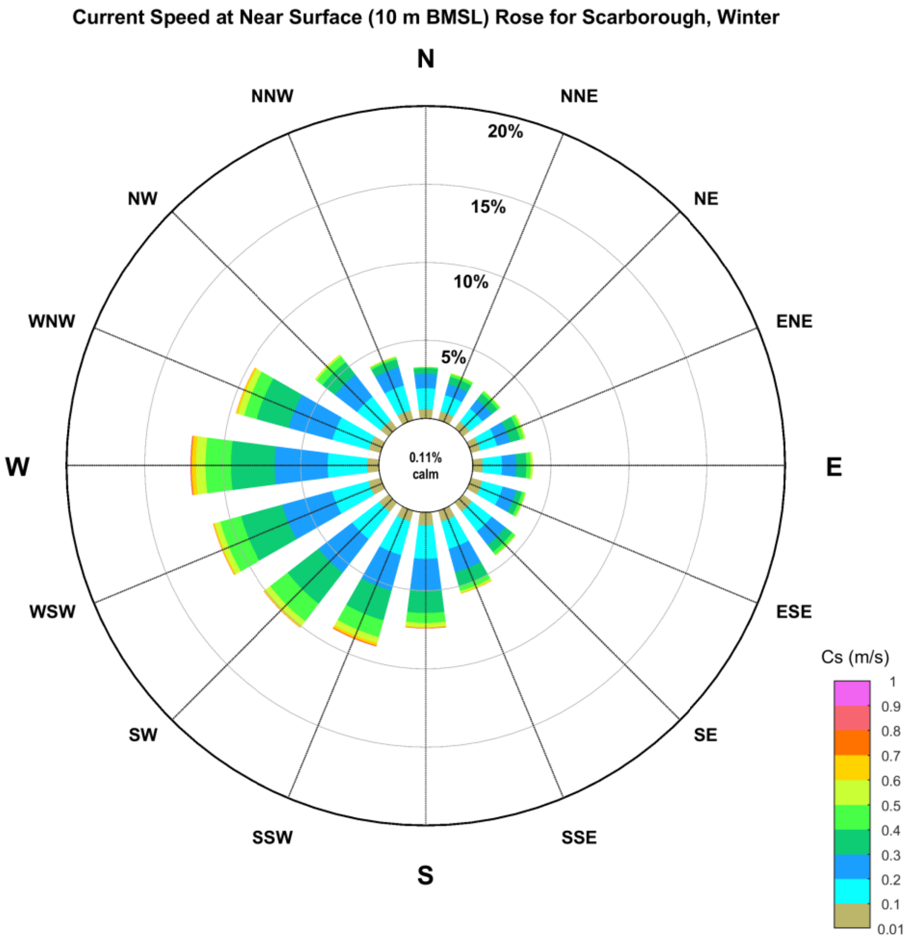


Data Information:
Project: North West Shelf
Location: Scarborough [113.2000°E, 19.8800°S]
Data Period: Summer (15-Jan-2010 to 29-Feb-2012)
Data Source: Measured Data
Record Elevation: Near Surface (10 m BMSL)
Local Water Depth (m): 950
Data Summary: Summer
Number of Records: 43600
Missing Data (%): 7.11
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).



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

Woodside

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).

North-west Cape

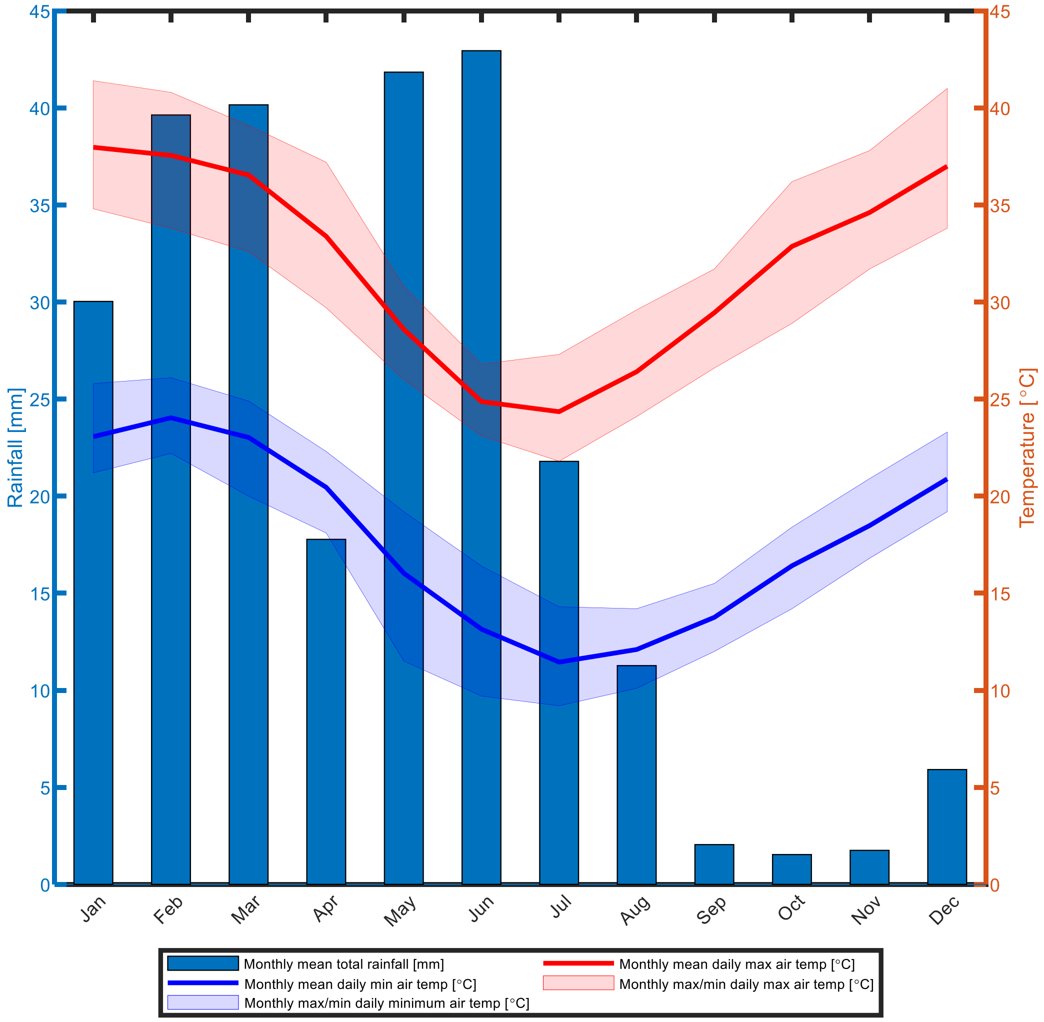
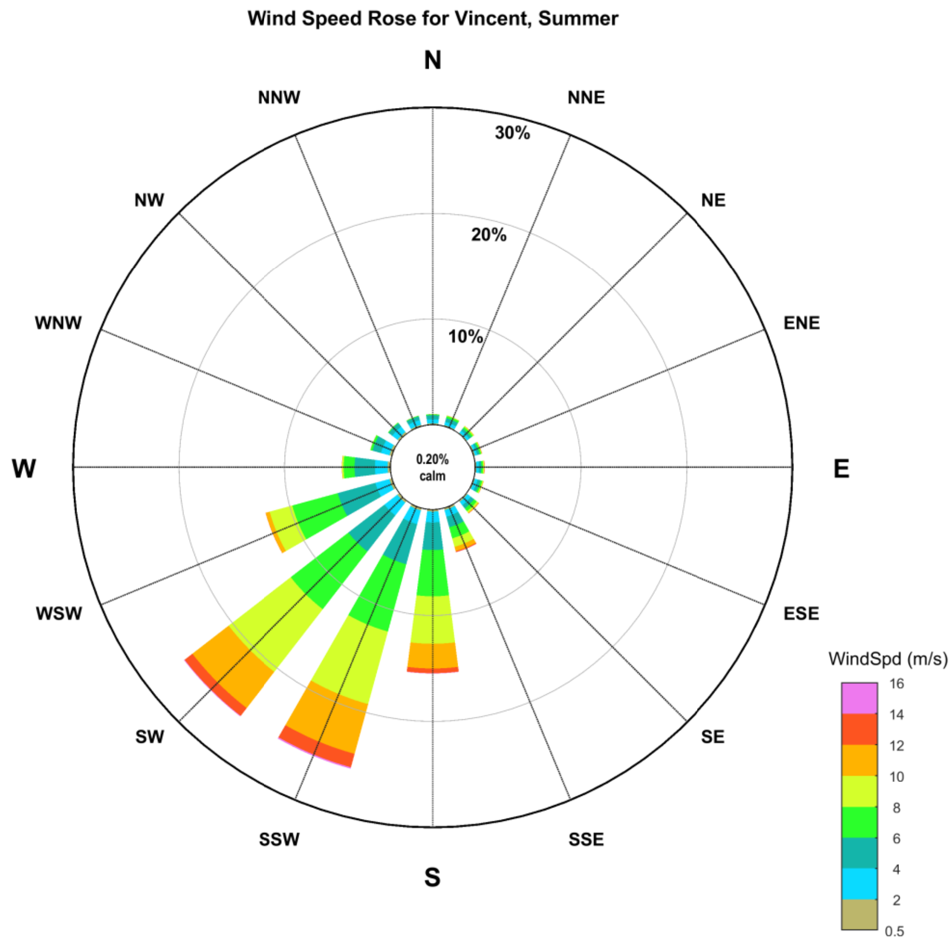


Figure 1. Monthly average total rainfall [mm] and air temperature [°C], calculated based on observations at the Learmonth Airport weather station from 1945-2020 and 1975-2020 respectively (Bureau of Meteorology 2020). Bars show the monthly average total rainfall values, and thick blue and red lines denote 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.

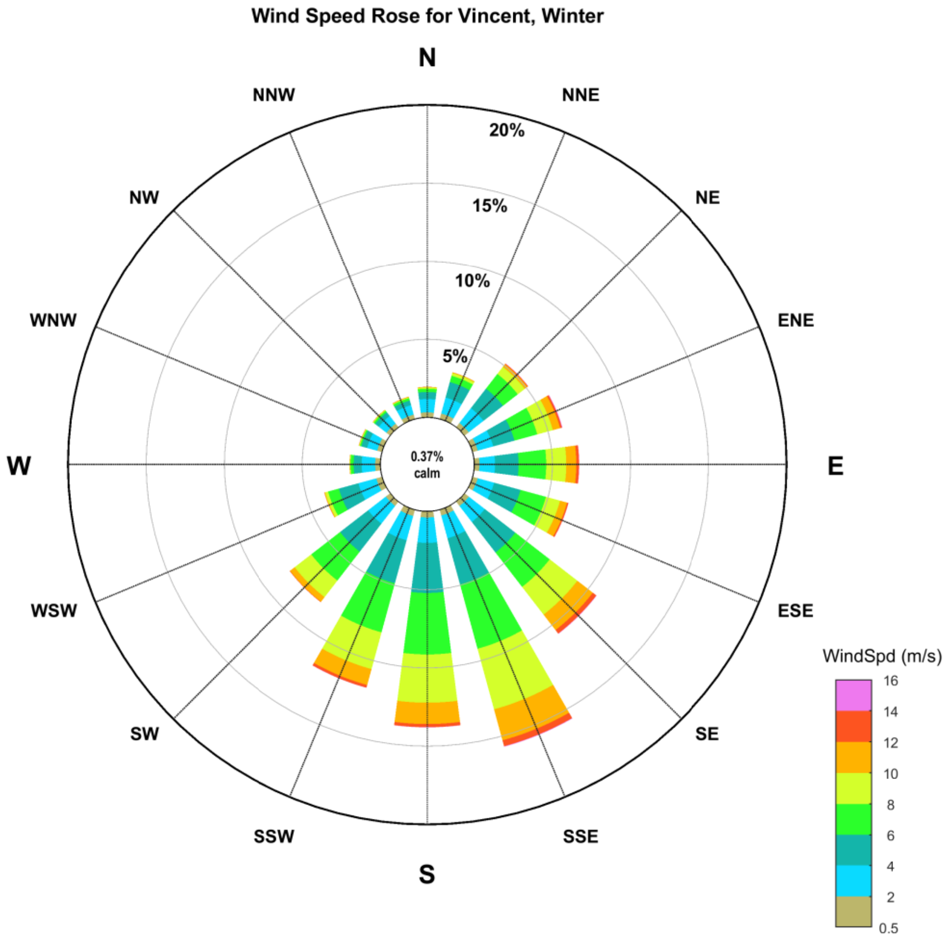


Data Information:
Project: North West Cape
Location: Vincent [114.0600°E, 21.4400°S]
Data Period: Summer (01-Jan-1979 to 01-Jan-2019)
Data Source: Modelled Hindcast
Record Elevation: 10 m AMSL
Local Water Depth (m): 350
Data Summary: Summer
Number of Records: 159379
Missing Data (%): 8.91
Calm (% < 0.50m/s): 0.20
Measurement Format: 10-minute avg.

Key Statistics for Data Shown:
Max Wind Speed: 18.86 m/s
Mean Wind Speed: 7.10 m/s
StdDev. Wind Speed: 2.75 m/s

Woodside

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).

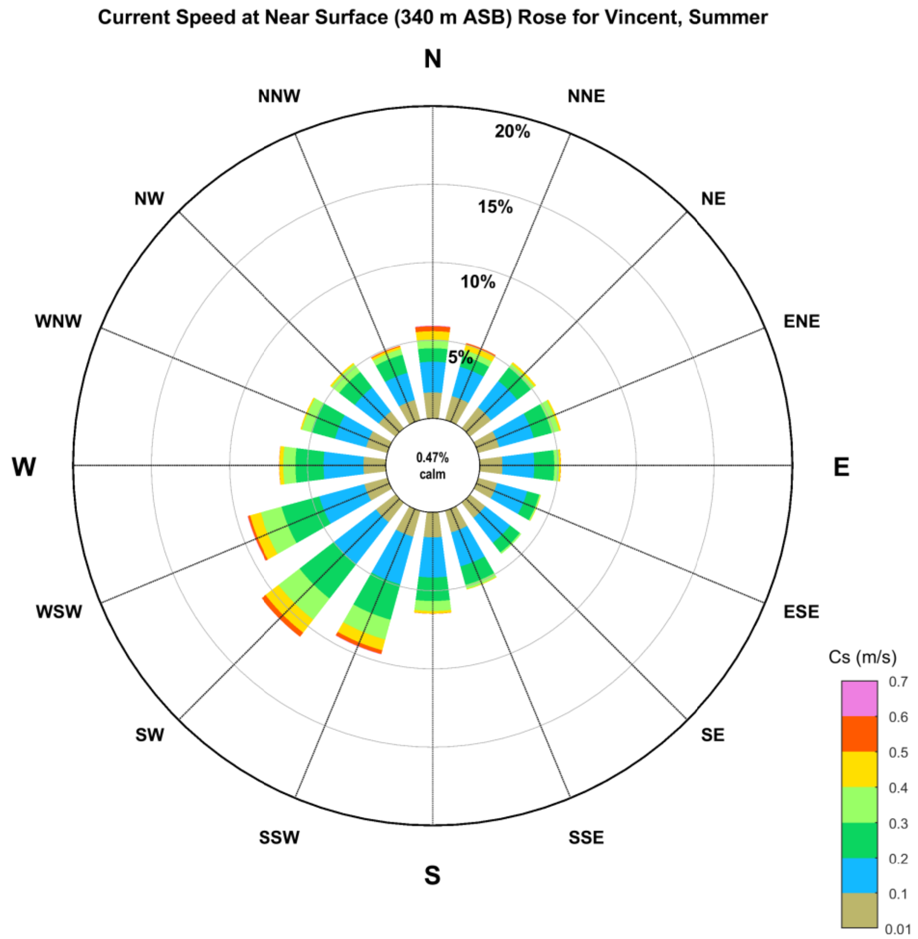


Data Information:
Project: North West Cape
Location: Vincent [114.0600°E, 21.4400°S]
Data Period: Winter (01-Apr-1979 to 30-Sep-2018)
Data Source: Modelled Hindcast
Record Elevation: 10 m AMSL
Local Water Depth (m): 350
Data Summary: Winter
Number of Records: 173626
Missing Data (%): 1.17
Calm (% < 0.50m/s): 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).

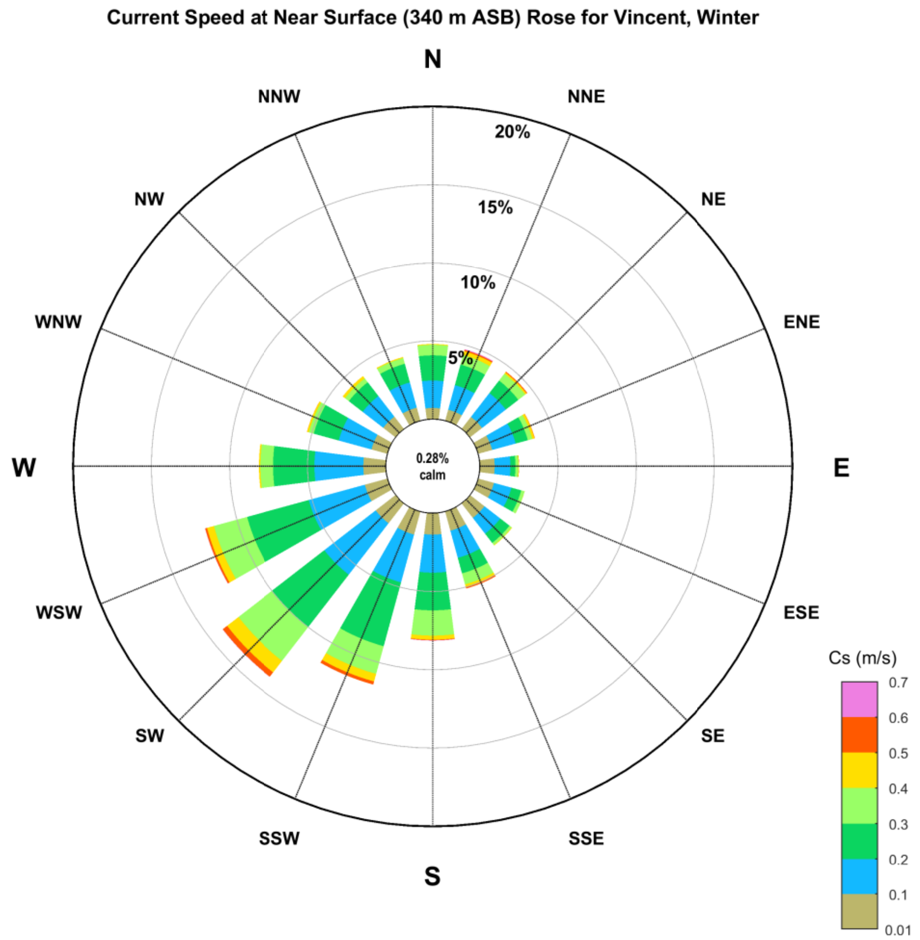


Data Information:
Project: North West Cape
Location: Vincent [114.0600°E, 21.4400°S]
Data Period: Summer (21-Nov-2000 to 13-Dec-2001)
Data Source: Measured Data
Record Elevation: Near Surface (340 m ASB)
Local Water Depth (m): 350
Data Summary: Summer
Number of Records: 144668
Missing Data (%): 1.59
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).



Data Information:
Project: North West Cape
Location: Vincent [114.0600°E, 21.4400°S]
Data Period: Winter (01-Apr-2001 to 30-Sep-2001)
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

Key Statistics for Data Shown:
Max Curr Spd: 0.64 m/s
Mean Curr Spd: 0.20 m/s
StdDev. Curr Spd: 0.11 m/s

Woodside

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).

REFERENCES

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Scarborough Seabed Intervention and Trunkline Installation Oil Pollution First Strike Plan

Security & Emergency Management
Hydrocarbon Spill Preparedness

December 2021
Revision 0

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SCARBOROUGH SEABED INTERVENTION AND TRUNKLINE INSTALLATION OIL POLLUTION FIRST STRIKE PLAN

SPILL FROM FACILITY INCLUDING SUBSEA INFRASTRUCTURE

(Note: Pipe laying and accommodation vessels are considered a "FACILITY" under Australian Regs).

LOCATION	LEVEL	CONTROL AGENCY	INCIDENT CONTROLLER
COMMONWEALTH WATERS	1	Woodside	Person In Charge (PIC) with support from Onshore Team Leader (OTL)
	2/3	Woodside	Corporate Incident Coordination Centre (CICC) DUTY MANAGER
STATE WATERS	1	Woodside	CICC Duty Manager
	2/3	Department of Transport (DoT)	DoT Incident Controller
WITHIN PORT LIMITS	1	Woodside	CICC Duty Manager
	2/3	Department of Transport (DoT)	DoT Incident Controller

SPILL FROM VESSEL

(Note: SOPEP should be implemented in conjunction with this document)

LOCATION	LEVEL	CONTROL AGENCY	INCIDENT CONTROLLER
COMMONWEALTH WATERS	1	Australian Marine Safety Authority (AMSA)	Vessel Master
	2/3	AMSA	AMSA (with response assistance from Woodside)
STATE WATERS	1	DoT	DoT Incident Controller
	2/3	DoT	DoT Incident Controller
WITHIN PORT LIMITS	1	Port Authority	Port Harbour Master
	2/3	Port Authority/ DoT	Port Harbour Master/ DoT Incident Controller

[1]See **Table A** for a guidance to incident characteristics of Levels 1 to 3

Guidance to Oil Spill Incident Levels

The most significant characteristic of the below guidance should be considered when determining level or escalation potential.

Table A: Guidance to the characteristics of incident Levels 1 to 3

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) Crisis Management Team (CMT) Activation	Onsite Incident Controller (IC) e.g. vessel master activated. Use of ICC support may be required.	Handover of Control from Onsite IC to Corporate Incident Coordination Centre (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 to years. 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 a Level 1 vessel spill arises with port limits, Woodside will notify the Port Authority who will become the Control Agency. In the event of a Level 2/3 spill arising from a vessel within port limits, the Control Agency will be agreed between the Port Authority and DoT.

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.

Response Process Overview

Use the below to determine actions required and which parts of this plan are relevant to the incident.		
For guidance on credible scenarios and hydrocarbon characteristics, refer to Appendix A.		
ALL INCIDENTS	Notify the Woodside Communication Centre (WCC) on: [redacted]	
	Incident Controller or delegate to make relevant notifications in **Table 1-1** of this Oil Pollution First Strike Plan.	
LEVEL 1	**FACILITY INCIDENT**	**VESSEL INCIDENT**
	Coordinate pre-identified tactics in **Table 2-1** of this Oil Pollution First Strike Plan. Remember to download each Operational Plan.	Notify AMSA or Port Authority (if within port limits) and coordinate pre-identified tactics in **Table 2-1** of this Oil Pollution First Strike Plan Remember to download each Operational Plan.
	If the spill escalates such that the site cannot manage the incident, inform the WCC on [redacted] and escalate to a level 2/3 incident.	
LEVEL 2/3	**FACILITY INCIDENT**	**VESSEL INCIDENT**
	Handover control to CICC and notify DoT or Port Authority (if within port limits)	Handover control to AMSA or Port Authority (if within port limits) and stand up CICC to assist.
	Commence quick revalidation of the recommended strategies on **Table 3-1** taking into consideration seasonal sensitivities and current situational awareness. Commence validated strategies.	If requested by AMSA/Port Authority: Commence quick revalidation of the recommended strategies on **Table 3-1** taking into consideration seasonal sensitivities and current situational awareness. Commence validated strategies.
	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 the OSPRMA Appendix A	If requested by AMSA/Port Authority: 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 the OSPRMA Appendix A

1. NOTIFICATIONS (ALL LEVELS)

The Incident Controller or delegate must ensure the below notifications **(Table 1-1)** are completed within the designated timeframes.

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).*							
In the event of an incident between campaign vessels, activate relevant vessel Emergency Response Plans and/or Bridging Documents							
In the event of an incident impacting Scarborough live well infrastructure, also activate Scarborough Drilling and Completions Oil Pollution First Strike Plan							
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	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	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]	App B Form 2	

[1] Notification to NOPSEMA must be from a Woodside Representative.

Notification timing	Responsibility	Authority/ Company	Name	Contact Number	Instruction	Form/ Template	Mark Complete (✓)
					NOPTA: [redacted] 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 if spill arises in or is likely to extend into port limits.	CICC DM or Delegate	Pilbara Ports Authority (PPA)	PPA Dampier Vessel Traffic Services (VTS)	VHF 11 (Port vessel working channel) VHF 16 (Port vessel emergency channel) Landline - (08) 9159 6556 24 hour emergency mobile - 0428 888 800.	Any spill within or close to the Dampier Port boundary should be reported immediately to the PPA Dampier VTS	Verbal	
As soon as practicable if spill is likely to extend into WA State waters.	CICC DM or Delegate	WA Department of Transport	DoT Maritime Environmental Emergency Response Unit (MEER) Duty Officer	08 9480 9924	Verbally notify DoT MEER Duty Officer that a spill has occurred and, if required, request use of equipment stored in Karratha. 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	CICC DM or Delegate	Department of Agriculture, Water and the Environment (Director of National Parks)	Marine Park Compliance Duty Officer	0419 293 465	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:	Verbal	

Notification timing	Responsibility	Authority/ Company	Name	Contact Number	Instruction	Form/ Template	Mark Complete (✓)
					• titleholder details • time and location of the incident • proposed response arrangements and locations as per the OPEP • contact details for the response coordinator • confirmation of access to relevant monitoring and evaluation reports when available.		
Without delay as per protection of the Sea Act, part II, section 11(1)	Vessel Master	Australian Maritime Safety Authority (AMSA)	Response Coordination Centre (RCC)	1800 641 792 or +61 2 6230 6811	Verbally notify AMSA RCC of the hydrocarbon spill. Follow up with a written Marine Pollution Report (POLREP) as soon as practicable following verbal notification.	App B Form 3	
ADDITIONAL LEVEL 2/3 NOTIFICATIONS							
As soon as practicable	CICC DM or Delegate	AMOSC	AMOSC Duty Manager	+61(0) 438 379 328	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 AMOS Plan and detail in a Service Contract that will be sent to Woodside from AMOSC upon activation.	App B Form 4	

Notification timing	Responsibility	Authority/ Company	Name	Contact Number	Instruction	Form/ Template	Mark Complete (✓)
As soon as practicable	CICC DM or Delegate	Oil Spill Response Limited (OSRL)	OSRL Duty Manager	+65 6266 1566	Contact OSRL duty manager and request assistance from technical advisor in Perth. Send the completed notification form to OSRL as soon as practicable. For mobilisation of resources, send the Mobilisation Form to OSRL as soon as practicable. The mobilisation form must be signed by a nominated callout authority from Woodside. OSRL can advise the names on the call out authority list, if required	Notification: App B Form 6a Mobilisation: App B Form 6b	
As soon as practicable if there is potential for oiled wildlife or the spill is expected to contact land or waters managed by WA Department of Biodiversity, Conservation and Attractions	CICC DM or Delegate	WA Department of Biodiversity, Conservation and Attractions (DBCA)	Duty Officer	(08) 9219 9108	Phone call notification	Verbal	
As soon as practicable if extra personnel are required for incident support	CICC DM or Delegate	Marine Spill Response Corporation (MSRC)	MSRC Response Manager	+1-732-417-0175 or +1-703-326-5609	Activate the contract with MSRC (in full) for the provision of up to 30 personnel depending on what skills are required. Please note that provision of these personnel from MSRC are on a best endeavours basis and are not guaranteed.	Verbal	

2. LEVEL 1 RESPONSE

2.1 Mobilisation of response techniques

For the relevant hydrocarbon type, undertake quick revalidation of the recommended techniques and pre-identified tactics indicated with a 'Yes' in Table 2-1**.** Undertake all validated pre-identified tactics immediately. These tactics should be carried out using the associated plan identified under Error! Reference source not found. 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 Scarborough Seabed Intervention and Trunkline Installation Environment Plan Appendix D (Woodside's Oil Spill Preparedness and Response Mitigation Assessment).

Table 2-1: Level 1 response summary

Response Techniques	Hydrocarbon Type Marine Diesel Oil	Pre- Identified Tactics	Responsible	ALARP Commitment Summary	Complete ✓	Link to Operational Plans for notification numbers and actions
Please consider instructing the CICC DM to activate or implement any of the following Pre-Identified tactics. The following tactics will assist in answering the '7 Questions of Spill Assessment' identified in Appendix C to increase situational awareness.						
Monitor and Evaluate (Operational Monitoring, OM02)	Yes	If a vessel is on location, consider the need to deploy the oil spill tracking buoy. If no vessel is on location, consider the need to mobilise oil spill tracking buoys from the King Bay Supply Base (KBSB) Stockpile. If a surface sheen is visible from the facility, deploy the satellite tracking buoy within two hours.	Operations	**DAY 1:** Tracking buoy deployed within two hours.		Surveillance and Reconnaissance to Detect Hydrocarbons and Resources at Risk (OM02 of The Operational Monitoring Operational Plan). Deploy tracking buoy in accordance with APPENDIX D.
Monitor and evaluate – predictive modelling (OM01)	Yes	Undertake initial modelling using the Rapid assessment oil spill tool and weathering fate analysis using ADIOS (or refer to the hydrocarbon information in Appendix A).	Intelligence or Environment	**DAY 1:** Initial modelling within six hours using the Rapid Assessment Tool.		Predictive Modelling of Hydrocarbons to Assess Resources at Risk (OM01 of The Operational Monitoring Operational Plan). *Planning to download immediately and follow steps*
	Yes	Send Oil Spill Trajectory Modelling (OSTM) form (Appendix B Form 7) to RPS Response response team (email [redacted]	Intelligence	**DAY 1:** Detailed modelling within four hours of RPS Response receiving information from Woodside.		
Monitor and evaluate – aerial surveillance (OM02)	Yes	Instruct Aviation Duty Manager to commence aerial observations in daylight hours. Aerial surveillance observer to 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). *Planning to download immediately and follow steps*
Monitor and evaluate – satellite tracking (OM02)	Yes	The Intelligence duty manager should be instructed to stand up KSAT to provide satellite imagery of the spill (email	Intelligence	**DAY 1:** Service provider will confirm availability of an initial acquisition within two hours.		

		[redacted]).		Data received to be uploaded into Woodside Common Operating Picture.		
Monitor and evaluate – monitoring hydrocarbons in water (OM03)	Yes	Consider the need to mobilise resources to undertake water quality monitoring (OM03).	Planning or Environment	**DAY 3:** Water quality 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).
Monitor and evaluate – pre-emptive assessment of receptors at risk (OM04)	Yes	Consider the need to mobilise resources to undertake pre-emptive assessment of sensitive receptors at risk (OM04).	Planning or Environment	**DAY 2:** In agreement with WA DoT, deployment of two specialists to reach of the Response Protection Areas (RPA) with predicted impacts.		Pre-emptive Assessment of Sensitive Receptors (OM04 of The Operational Monitoring Operational Plan).
Monitor and evaluate – shoreline assessment (OM05)	Yes	Consider the need to mobilise resources to undertake shoreline assessment surveys (OM05).	Planning or Environment	**DAY 2:** In agreement with WA DoT, deployment of two specialists in shoreline clean-up assessment (SCAT) for each of the RPAs with predicted impacts.		Shoreline Assessment (OM05 of The Operational Monitoring Operational Plan).
Shoreline Protection and Deflection	Potentially	Equipment from Woodside and/or PPA (if within port limits) mobilised. If required additional equipment mobilised from AMOSC and AMSA Western Australian stockpiles.	Logistics and Planning	**DAY 1:** In agreement with WA DoT and/or PPA (if within port limits), activate relevant Tactical Response Plans (TRPs) within 12 hours. In agreement with WA DoT and/or PPA (if within port limits), mobilise teams to RPAs within 12 hours of operational monitoring predicting impacts. In agreement with WA DoT and/or PPA (if within port limits), equipment mobilised from closest stockpile within 12-hours. Supplementary equipment mobilised from AMOSC, AMSA stockpiles within 24 hours		Protection and Deflection Operational Plan *Logistics to download immediately and follow steps*

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 Scarborough Seabed Intervention and Trunkline Installation Environment Plan Appendix D (Woodside’s Oil Spill Preparedness and Response Mitigation Assessment).

Table 3-1: Level 2/3 response summary

Response Techniques	Hydrocarbon Type Marine Diesel Oil	Pre- Identified Tactics	Responsible	ALARP Commitment Summary	Complete ✓	Link to Operational Plans for notification numbers and actions
Monitor and evaluate – tracking buoy (OM02)	Yes	If a vessel is on location, consider the need to deploy the oil spill tracking buoy. If no vessel is on location, consider the need to mobilise oil spill tracking buoys from the King Bay Supply Base (KBSB) Stockpile. If a surface sheen is visible from the facility, deploy the satellite tracking buoy within two hours.	Operations	**DAY 1:** Tracking buoy deployed within two hours.		Surveillance and Reconnaissance to Detect Hydrocarbons and Resources at Risk (OM02) of The Operational Monitoring Operational Plan. Deploy tracking buoy in accordance with **Error! Reference source not found.**.
Please consider instructing the CICC DM to activate or implement any of the following Pre-Identified tactics. The following tactics will assist in answering the '7 Questions of Spill Assessment' identified in Appendix C to increase situational awareness.						
Monitor and evaluate – predictive modelling (OM01)	Yes	Undertake initial modelling using the Rapid assessment oil spill tool and weathering fate analysis using ADIOS (or refer to the hydrocarbon information in Appendix A).	Intelligence or Environment	**DAY 1:** Initial modelling within six hours using the Rapid Assessment Tool.		Predictive Modelling of Hydrocarbons to Assess Resources at Risk (OM01 of The Operational Monitoring Operational Plan). *Planning to download immediately and follow steps*
	Yes	Send Oil Spill Trajectory Modelling (OSTM) form (Appendix B Form 7) to RPS Response ([redacted]).	Intelligence	**DAY 1:** Detailed modelling within 4 hours of RPS Response receiving information from Woodside.		
Monitor and evaluate – aerial surveillance (OM02)	Yes	Instruct Aviation Duty Manager to commence aerial observations in daylight hours. Aerial surveillance observer to complete log in Appendix B Form 8.	Logistics - Aviation	**DAY 1:** Two trained aerial observers. One aircraft available. Report made available to the IMT within two hours of landing after each sortie.		Surveillance and Reconnaissance to Detect Hydrocarbons and Resources at Risk (OM02 of The Operational Monitoring Operational Plan). Planning to download immediately and follow steps
Monitor and evaluate – satellite tracking (OM02)	Yes	The Intelligence duty manager should be instructed to stand up Kongsberg Satellite Services (KSAT) to provide satellite imagery	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.		

		of the spill. [redacted]				
Monitor and evaluate – monitoring hydrocarbons in water (OM03)	Yes	Consider the need to mobilise resources to undertake water quality monitoring (OM03).	Planning or Environment	**DAY 3:** Water quality assessment access and capability Daily fluorometry reports will be provided to IMT.		Detecting and Monitoring for the Presence and Properties of Hydrocarbons in the Marine Environment (OM03 of The Operational Monitoring Operational Plan).
Monitor and evaluate – pre-emptive assessment of receptors at risk (OM04)	Yes	Consider the need to mobilise resources to undertake pre-emptive assessment of sensitive receptors at risk (OM04).	Planning or Environment	**DAY 2:** In agreement with WA DoT, deployment of two specialists for each of the Response Protection Areas (RPA) with predicted impacts.		Pre-emptive Assessment of Sensitive Receptors (OM04 of The Operational Monitoring Operational Plan).
Monitor and evaluate – shoreline assessment (OM05)	Yes	Consider the need to mobilise resources to undertake shoreline assessment surveys (OM05).	Planning or Environment	**DAY 2:** In agreement with WA DoT, deployment of two specialists in SCAT for each of the RPAs with predicted impacts.		Shoreline Assessment (OM05 of The Operational Monitoring Operational Plan).
Surface Dispersant	No	This response strategy is not recommended.				
Containment and Recovery	No	This response strategy is not recommended.				
Mechanical Dispersion	No	This response strategy is not recommended.				
In-situ Burning	No	This response strategy is not recommended.				
Shoreline Protection and Deflection	Yes	Equipment from Woodside, PPA (if within port limits), AMOSC and AMSA Western Australian Stockpiles mobilised. Consideration of mobilisation of interstate/international shoreline protection equipment (i.e. OSRL).	Logistics and Planning	**DAY 1:** In agreement with WA DoT and/or PPA (if within port limits), activate relevant Tactical Response Plans (TRPs) within 12 hours. In agreement with WA DoT and/or PPA (if within port limits), mobilise teams to		Protection and Deflection Operational Plan *Logistics to download immediately and follow steps*

				RPAs within 12 hours of operational monitoring predicting impacts. In agreement with WA DoT and/or PPA (if within port limits), equipment mobilised from closest stockpile within 12-hours. Supplementary equipment mobilised from AMOSC, AMSA stockpiles within 24 hours **DAY 2:** Supplementary equipment mobilised from OSRL within 48 hours (if required)		
Shoreline Clean Up	Yes	Equipment from Woodside, and/or PPA (if within port limits) 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:** In agreement with WA DoT and/or PPA (if within port limits), activate relevant Tactical Response Plans (TRPs) within 12 hours. Equipment mobilised from closest stockpile within 24 hours **DAY 2:** Deployment of shoreline clean-up teams to contaminated RPAs. Supplementary equipment mobilised from State, AMOSC, AMSA stockpiles within 48 hours, if required. Access to at least 213 m^3 of solid and liquid waste storage available within 2 days upon activation of 3rd party contract.		Shoreline Clean-up Operational Plan *Logistics to download immediately and follow steps*
Oiled Wildlife Response	Yes	If oiled wildlife is a potential impact, request AMOSC to mobilise containerised oiled wildlife first strike kits and relevant personnel. Refer to relevant Tactical Response Plan for potential wildlife at risk. Mobilise AMOSC Oiled Wildlife Containers.	Logistics and Planning	**DAY 5:** Contracted capability to treat up to an additional 250 individual fauna within a five-day period. Facilities for oiled wildlife rehabilitation are operational 24/7.		Oiled Wildlife Response Operational Plan

		Consider whether additional equipment is required from local suppliers.				
Scientific Monitoring (Type II)	**Yes**	Notify Woodside science team of spill event.	Environment			Oil Spill Scientific Monitoring Programme – Operational Plan

4. PRIORITY RECEPTORS

Note: DoT are the Control Agency to respond to all the sites listed below in a Level 2/3 spill into State waters/shorelines.

Action: Provide DoT with all relevant Tactical Response Plans for Priority Protection Areas.

Stochastic modelling has been completed for a worst case spill scenario of an instantaneous surface release of 2000 m^3 of marine diesel, representing loss of vessel fuel tank integrity after a collision, at three locations: outside Mermaid Sound (Credible Scenario-01 (CS-01)), within Montebello Marine Park (Credible Scenario-02 (CS-02)) and at the proposed Floating Production Unit (FPU) location in the Scarborough field (Credible Scenario-03 (CS-03)). Only CS-01 results in any impacts at response threshold and has therefore been used to plan and scale the response.

Based on hydrocarbon spill risk modelling results for the three scenarios 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 response 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 100 ppb entrained hydrocarbon concentration) are used to determine the environment that may be affected (EMBA) 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 monitoring [2]
50	Predicted minimum floating oil threshold for containment and recovery and surface dispersant application [3]
100	Predicted optimum floating oil threshold for containment and recovery and surface dispersant application
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

Receptor	Distance and Direction from Operational Area (km)	Minimum time to shoreline contact (above 100 g/m^2) in days	Maximum shoreline accumulation (above 100 g/m^2) in m^3	Tactical Response Plans
Dampier Archipelago	13 km East	53 hours (2.2 days) *NB >48 hour criteria but included for conservatism*	3	Legendre Island – Dampier Rosemary Island - Dampier Additional TRPs available via this Link
Open Ocean – Commonwealth Waters	Overlaps	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:

[2] Operational monitoring will be undertaken from the outset of a spill whether or not this threshold has been reached. Monitoring is needed throughout the response to assess the nature of the spill, track its location and inform the need for any additional monitoring and/or response techniques. It also informs when the spill has entered State Waters and/or control of the incident passes to WA DoT or AMSA.

[3] 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 displaying the spread of surface oil.

- Dampier MP (surface hydrocarbon concentrations ≥10 g/m^2)
- Montebello MP (surface hydrocarbon concentrations ≥10 g/m^2)
- Gascoyne MP (surface hydrocarbon concentrations ≥10 g/m^2)

Tactical Response plans for these locations can be accessed via the Oil Spill Portal - Tactical Response Plans. Oil Spill Trajectory Modelling specific to the spill event will be required to determine the regional sensitive receptors to be contacted beyond 48 hours of a spill.

Figure 4-1 illustrates the location of regional sensitive receptors in relation to the Scarborough Seabed Intervention operational area and identifies priority protection areas.

Consideration should be given to other stakeholders (including mariners) in the vicinity of the spill location. **Table 4-3** indicates the assets within the vicinity of the Scarborough Seabed Intervention and Trunkline Installation Operational Area.

Table 4-3: Assets in the vicinity of the Scarborough Seabed Intervention and Trunkline Installation Operational Area

Asset	Distance and Direction from Operational Area	Operator
Dampier Port	0 km – from eastern end of trunkline	Pilbara Port Authority
Pluto Platform	2 km north	Woodside
Stag Platform	5 km south	Jadestone
Wheatstone Platform	10 km north	Chevron
Reindeer Platform	15 km north	Santos
Goodwyn Platform	48 km north	Woodside

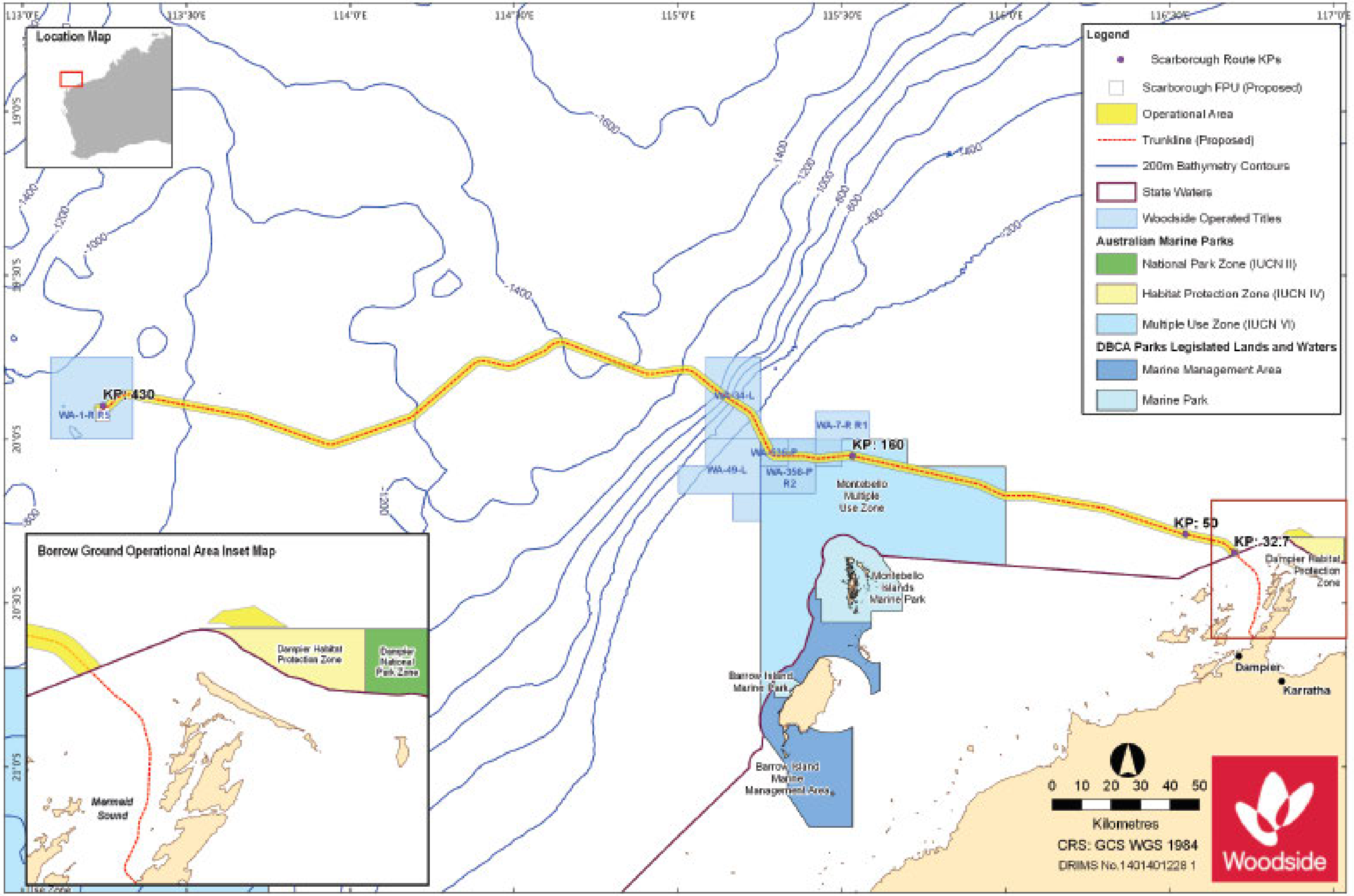


Figure 4-1 Regional Sensitive Receptors – Scarborough Seabed Intervention and Trunkline Installation

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*
WCCS: **Instantaneous release from Vessel Collision outside Mermaid Sound (CS-01)**	Marine Diesel	2000 m^3 release volume resulting in 100 m^3 residual oil on water surface	Diesel Fuel Oil (Southern USA 1) API of 37.2
Instantaneous release from Vessel Collision within Montebello Marine Park (CS-02)	Marine Diesel	2000 m^3 release volume resulting in 100 m^3 residual oil on water surface	Diesel Fuel Oil (Southern USA 1) API of 37.2
Instantaneous release from Vessel Collision at the proposed Floating Production Unit (FPU) location in the Scarborough field (CS-03)	Marine Diesel	2000 m^3 release volume resulting in 100 m^3 residual oil on water surface	Diesel Fuel Oil (Southern USA 1) API of 37.2

*Initial screening of possible ADIOS2 analogues was done by considering hydrocarbons with similar APIs. Suggested selection was based on the closest distillation cut to WEL hydrocarbon. Only hydrocarbons with distillation cuts that showed results for > 380°C were included in selection process.

Marine Diesel (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.

The mass balance forecast for the constant calm wind case (**Figure A-1**) for marine diesel shows that approximately 45% of the oil is predicted to evaporate within 24 hours. Under these 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 the variable-wind case (**Figure A-2)**, where the winds are of greater strength, entrainment of marine diesel into the water column is indicated to be significant. Approximately 24 hours after the spill, around 45% of the oil mass is forecast to have entrained and a further 35% is forecast to have evaporated, leaving only a small proportion of the oil floating on the water surface (<1%). The residual compounds will tend to remain entrained beneath the surface under conditions that generate wind waves (approximately >6 m/s).

The increased level of entrainment in the variable-wind case will result in a higher percentage of biological and photochemical degradation, where the decay of the floating slicks and oil droplets in the water column occurs at an approximate rate of 1.8% per day with an accumulated total of ~13% after 7 days, in comparison to a rate of ~0.2% per day and an accumulated total of 1.5% after 7 days in the constant-wind case. 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. This long weathering duration will extend the area of potential effect, requiring the break-up and dispersion of the slicks and droplets to reduce concentrations below the thresholds

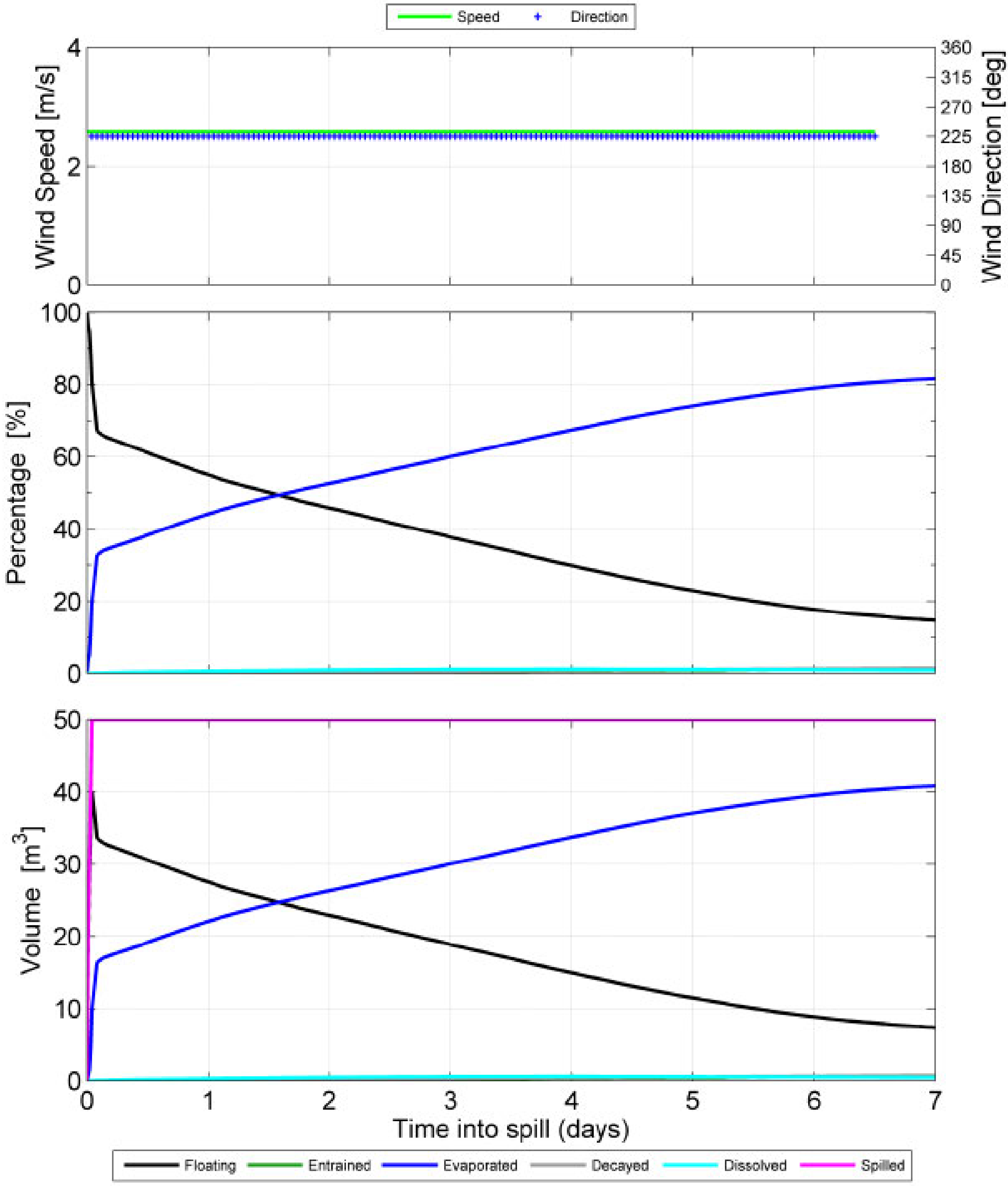


Figure A-1: Mass balance plot representing, as proportion (middle panel) and volume (bottom panel) the weathering of marine diesel spilled onto the water surface as a one-off release (50m^3 over 1 hour) and subject to a constant 5kn (2.6 m/s) wind at 27°C water temperature and 25°C air temperature.

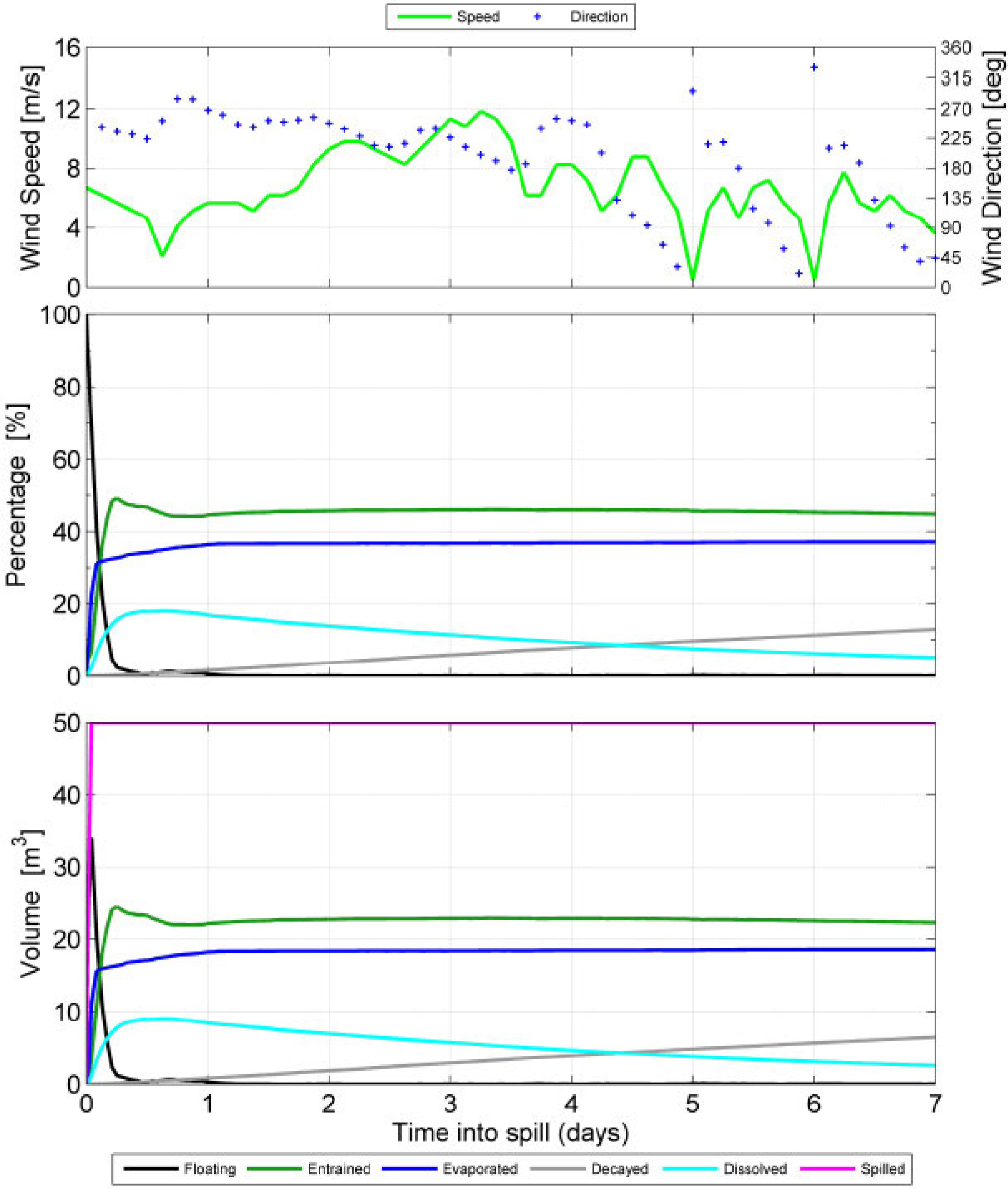


Figure A-2: Mass balance plot representing, as proportion (middle panel) and volume (bottom panel), the weathering of marine diesel spilled onto the water surface as a one-off release (50m^3 over 1 hour) and subject to variable wind at 27°C water temperature and 25°C air temperature.

APPENDIX B – FORMS

Form No.	Form Name	Link
1	Record of Initial Verbal Notification to NOPSEMA Template	[redacted]
2	NOPSEMA Incident Report Form	[redacted]
3	Marine Pollution Report (POLREP – AMSA)	[redacted]
4	AMOSC Service Contract Note	[redacted]
5	Marine Pollution Report (POLREP – DoT)	[redacted]
6a	OSRL Initial Notification Form	[redacted]
6b	OSRL Mobilisation Activation Form	[redacted]
7	RPS Response Oil Spill Trajectory Modelling Request	[redacted]
8	Aerial Surveillance Observer Log	[redacted]

FORM 1

Record of initial verbal notification to NOPSEMA

(NOPSEMA phone: [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 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]

FORM 2

[insert NOPSEMA Incident Report Form when printing]

[redacted]

FORM 3

[insert Marine Pollution Report (POLREP – AMSA) when printing]

[redacted]

FORM 4

[insert AMOSC Service Contract note when printing]

[redacted]

FORM 5

[insert Marine Pollution Report (POLREP – DoT) when printing]

[redacted]

FORM 6a

[insert OSRL Initial Notification Form when printing]

[redacted]

FORM 6b

[insert OSRL Mobilisation Activation Form when printing]

[redacted]

FORM 7

[insert RPS Response Oil Spill Trajectory Modelling Request form when printing]

[redacted]

FORM 8

[insert Aerial Surveillance Observer Log when printing]

[redacted]

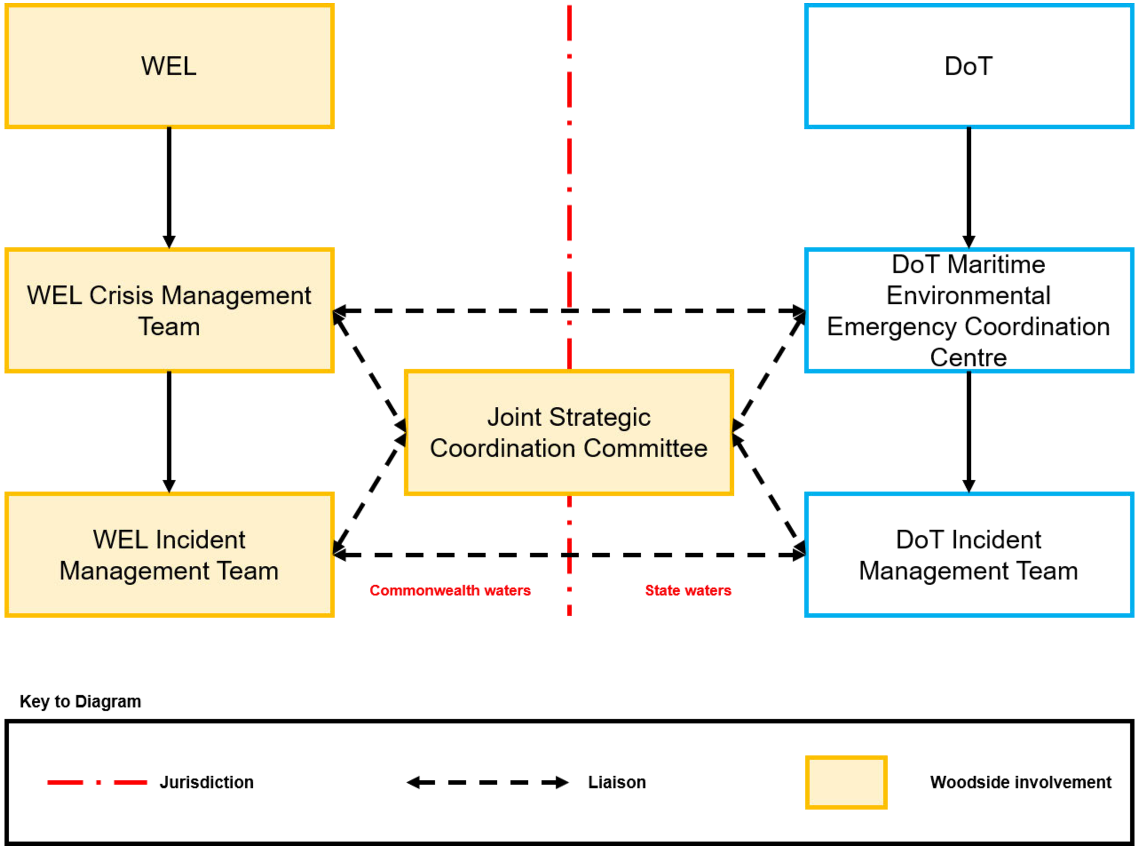
APPENDIX C – 7 QUESTIONS OF SPILL ASSESSMENT

WHAT IS IT? **Oil Type/name** **Oil properties** **Specific gravity / viscosity / pour point / asphaltenes/ wax content / boiling point**	
WHERE IS IT? Lat/Long Distance and bearing	
HOW BIG IS IT? Area Volume	
WHERE IT IS GOING? Weather conditions Currents and tides	
WHAT IS IN THE WAY? Resources at risk	
WHEN WILL IT GET THERE? Weather conditions Currents and tides	
WHAT'S HAPPENING TO IT? Weathering processes	

APPENDIX D – TRACKING BUOY DEPLOYMENT INSTRUCTIONS

(Insert [redacted] when printing)

APPENDIX E – COORDINATION STRUCTURE FOR A CONCURRENT HYDROCARBON SPILL IN BOTH COMMONWEALTH AND STATE WATERS/SHORELINES[4]

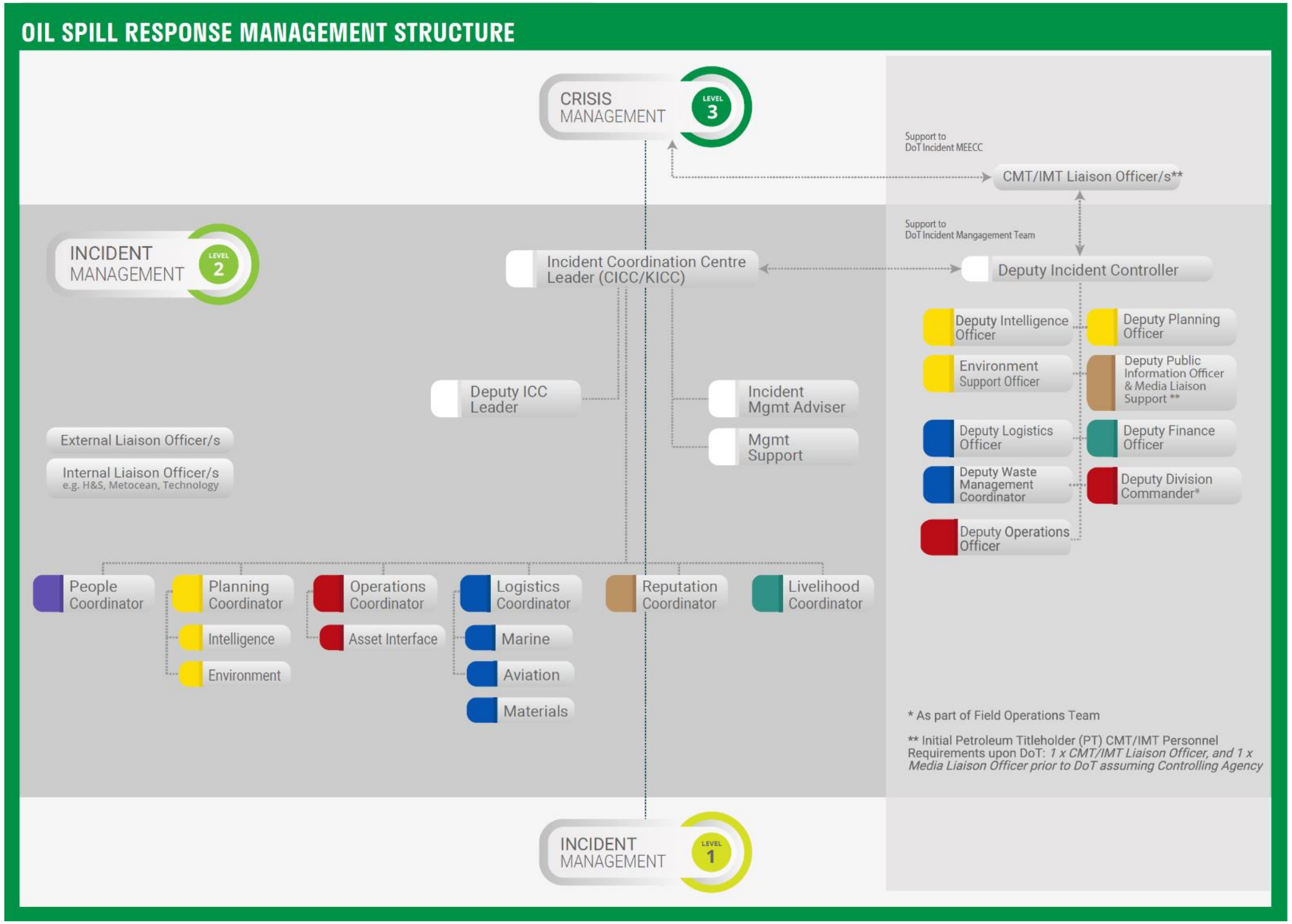


The Control Agency for a hydrocarbon spill in Commonwealth waters resulting from an offshore petroleum activity is Woodside (the Petroleum Titleholder). The Control Agency for a hydrocarbon spill in State waters/shorelines resulting from an offshore petroleum activity is DoT. DoT will appoint an Incident Controller and form a separate IMT to only manage the spill within State waters/shorelines.

[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.

APPENDIX F – WOODSIDE INCIDENT MANAGEMENT STRUCTURE

Woodside Incident Management Structure for Hydrocarbon Spill (including Woodside Liaison Officers Command Structure within DoT IMT if required).



APPENDIX G – WOODSIDE LIASON OFFICER RESOURCES TO DOT

Once DoT activates a State waters/shorelines IMT, Woodside will make available the following roles to DoT.

Area	WEL Liaison Role	Personnel Sourced from[5]:	Key Duties	#
DoT MEECC	CMT Liaison Officer	CMT 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 Planning-Plans/ Resources	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. • Facilitate the provision of relevant IAP and sub plans from the PT IMT.	1

[5] See [redacted]

Area	WEL Liaison Role	Personnel Sourced from[5]:	Key Duties	#
		Coordinator Reserve List and Planning Group 3	• 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

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

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