Stybarrow End State Decommissioning Environment Plan

Stybarrow Decommissioning

Document No: BHPB-00SC-N000-0007

Rev	Date	Description	Prepared By	Checked By	Reviewed By	Approved By
0	29/07/2022	Issued to NOPSEMA for Assessment	Advisian	Principal Decommissioning Project Engineer	Regional HSE Lead	VP Australia Projects

Revision Record		
Rev	**Date**	**Description**
A	13/06/2022	Draft issued for review
B	25/07/2022	Draft issued for review
0	29/07/2022	Issued to NOPSEMA for Assessment

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Acronym and Glossary

Term	Description
AFMA	Australian Fisheries Management Authority
AHO	Australian Hydrographic Office
AHP	Analytic hierarchy process
AIS	Automatic Identification System
ALARP	As low as reasonably practicable
AMP	Australian Marine Park
AMSA	Australian Maritime Safety Authority
ANZECC	Australian and New Zealand Environment and Conservation Council
API	American Petroleum Institute
APPEA	Australian Petroleum Production and Exploration Association
APU	Australian Production Unit
ARMCANZ	Agriculture and Resource Management Council of Australia and New Zealand
BIA	Biologically Important Area
CCG	Cape Conservation Group
CEO	Chief Executive Officer
CP	Cathodic protection
CRG	Community Reference Group
CSIRO	Commonwealth Scientific and Industrial Research Organisation
DCCEEW	Department of Climate Change, Energy, Environment and Water (formerly Department of Agriculture, Water and the Environment)
DGV	Default Guideline Value
DISER	Department of Industry, Science, Energy and Resources
DoD	Department of Defence

Term	Description
DOIR	WA Department of Industry and Resources
DTM	Disconnectable Turret Mooring
EIA	Environmental impact assessment
EMBA	Environment that may be affected
ENVID	Environmental hazard identification
Environment Regulations	Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2009
EP	Environment Plan
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999*
EPO	Environmental Performance Outcome
EPS	Environmental Performance Standard
ESD	Ecologically Sustainable Development
FPSO	Floating Production, Storage and Offloading
GVI	General visual inspection
HSE	Health, Safety and Environment
HSEC	Health Safety Environment Committee
IMCRA	Integrated Marine and Coastal Regionalisation of Australia
IMO	International Maritime Organization
IT	Information Technology
IUCN	International Union for the Conservation of Nature
KEF	Key Ecological Feature
MC	Measurement Criteria
MNES	Matters of National Environmental Significance

Term	Description
MPA	Marine Protected Area
NOPSEMA	National Offshore Petroleum Safety and Environmental Management Authority
NOPTA	National Offshore Petroleum Titles Administrator
NWS	North West Shelf
OPGGS Act	*Offshore Petroleum and Greenhouse Gas Storage Act 2006*

Term	Description
OSPAR	Convention for the Protection of the Marine Environment of the North-East Atlantic
P&A	Plug and abandonment
PMST	Protected Matters Search Tool
PS	Performance Standard
ROV	Remotely Operated Vehicle
Woodside	Woodside Energy (Australia) Pty Ltd

1 Introduction

1.1 Proposed Activity

Woodside Energy (Australia) Pty Ltd (Woodside) as Titleholder of production licence WA-32-L under the *Offshore Petroleum and Greenhouse Gas Storage Act 2006* (the OPGGA Act), proposes to abandon *in situ* selected equipment within the Stybarrow field within WA-32-L. The equipment proposed for abandonment *in situ* consists of:

- Dis-connectable turret mooring (DTM) anchors
- Suction piles associated with:
  - Nine riser bases
  - One water injection manifold foundation
- Wellhead:
  - One wellhead, Eskdale-1, where previous attempts to remove the wellhead were unsuccessful.

Abandonment *in situ* of this equipment will hereafter be referred to as the petroleum activity and forms the scope of this environment plan (EP). A detailed description of the petroleum activity is provided in Section 3.

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

1.2 Woodside/BHP Petroleum Merger

BHP and Woodside announced their intention to merge BHP's global petroleum business with Woodside in 2021. The merger completed on 1 June 2022. Prior to the completion date, BHP and Woodside acted as independent companies and planning activities for this decommissioning EP were conducted independently. The merger consisted of sale of all shares in BHP Petroleum International Pty Ltd (the holding company for BHP's global petroleum business) from BHP Group Ltd to Woodside Energy Group Ltd. All BHP entities holding Australian petroleum titles have transferred to Woodside ownership. All BHP Petroleum policies, standards, processes and procedures were included in the merger agreement and remain valid. Harmonisation of processes between BHP Petroleum and Woodside commenced planning upon the completion of the merger and will be conducted in a staged manner. The BHP Petroleum HSE Management system will continue to be used by 'heritage' BHP operations until potential changes have been assessed. References to BHP, BHP Petroleum and Woodside are interchangeable throughout this document.

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 from planned (routine and non-routine) activities and unplanned events (including emergency situations) of the petroleum activity are identified and described,
- appropriate management controls are implemented to reduce impacts and risks to a level that is 'as low as reasonably practicable' (ALARP) and acceptable, and
- the petroleum activity 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* (EPBC Act)).

The EP describes the process used by Woodside to identify and evaluate potential environmental impacts and risks arising from the petroleum activity, and defines the environmental performance outcomes, performance standards and measurement criteria to be applied to manage the impacts and risks to ALARP and acceptable levels. This EP includes an implementation strategy for monitoring, auditing, and managing the petroleum activity to be performed by Woodside and its contractors. The EP documents and considers consultation with relevant authorities, persons, and organisations.

1.4 Scope of this Environment Plan

A detailed description of the petroleum activity is provided in Section 4. The spatial boundary of the petroleum activity has been described and assessed using the operational area, which is described in Section 4.5.

Other activities relevant to the decommissioning of the Stybarrow field are covered in other EPs and include:

- Management and removal of most of the subsea equipment in the Stybarrow field, addressed in Stybarrow Decommissioning and Field Management EP (BHPB-00SC-N000-003)
- Plug and abandonment of shut-in wells in the Stybarrow field, addressed in the Stybarrow Plug and Abandonment EP (BHPB-00SC-N000-0005)

1.5 Overview of Health, Safety and Environmental Management System

All Woodside-controlled activities associated with the petroleum activity will be conducted in line with:

- Woodside “Our Values” (Appendix A),
- Woodside Environment and Climate Change – Our Requirements,
- Woodside Wells and Seismic Delivery Management System,
- Australia Production Unit (APU) Management System,
- Woodside Petroleum Health, Safety and Environment (HSE) Standard,
- any specific commitments laid out in this EP.

All Woodside sites must maintain up-to-date practices that adhere to the requirements contained in the Petroleum Health, Safety and Environment Management System and Standard. Activity-specific environmental management measures specific to the petroleum activity are implemented through this EP.

1.6 Environment Plan Summary

The requirement in Regulation 11(4) of the Environment Regulations for an EP summary has been met by the material provided in this EP. Table 1-1 maps the EP summary requirements to the relevant content within this EP.

Table 1-1: EP summary

EP Summary Material Requirement	Relevant Section of the EP
A description of the activity	Section 4
The location of the activity	Section 4.2
A description of the receiving environment	Section 5
Details of the environmental impacts and risks	Section 8
The control measures for the activity	Section 8
The arrangements for ongoing monitoring of the titleholder’s environmental performance	Section 10
Response arrangements in the oil pollution emergency plan	Not applicable
Consultation already undertaken and plans for ongoing consultation	Section 6
Details of the titleholder’s nominated liaison person for the activity	Section 1.9

1.7 General Direction 833

NOPSEMA issued General Direction 833 to Woodside on 30 August 2021. Table 1-2 provides the directions within General Direction 833 and references the relevant sections of this EP where applicable.

Table 1-2: NOPSEMA General Direction 833 requirements and relevant sections of this EP

Direction Number	Relevant Sections of this EP
Direction 1 Plug or close off, to the satisfaction of NOPSEMA, all wells made in the title area by any person engaged or concerned in operations authorised by the title as soon as practicable and no later than 30 September 2024.	Direction 1 is not applicable to this EP. The plug and abandonment of shut-in wells is covered in the Stybarrow Plug and Abandonment EP (BHPB-00SC-N000-0005).
Direction 2 Remove, or cause to be removed, to the satisfaction of NOPSEMA, from the title area all property brought into that area by any person engaged or concerned in the operations authorised by the title as soon as practicable and no later than 31 March 2025.	Most of the equipment subject to Direction 2 will be removed under the Stybarrow Decommissioning and Field Management EP (BHPB-00SC-N000-003) and the Stybarrow Plug and Abandonment EP (BHPB-00SC-N000-0005). The abandonment *in situ* of the equipment within the scope of this EP is an alternative to NOPSEMA's direction to remove all property. This alternative is sought by Woodside in accordance with the *Guideline: Offshore Petroleum Decommissioning* (Department of Industry, Science, Energy and Resources, 2022) and NOPSEMA's *Section 572 Maintenance and Removal of Property* (2020) policy. The environmental impact assessment of feasible decommissioning options demonstrating abandonment *in situ* yields equal or better environmental outcomes than full removal is provided in Section 3.
Direction 3 Until such time as direction 1 and 2 are complete, maintain all property on the title to NOPSEMA's satisfaction, to ensure removal of the property is not precluded.	Direction 3 is not applicable to this EP. Maintenance of property prior to decommissioning is covered in the Stybarrow Decommissioning and Field Management EP (BHPB-00SC-N000-0003).
Direction 4 Provide, to the satisfaction of NOPSEMA, for the conservation and protection of the natural resources in the title area within 12 months after property referred to in direction 2 is removed.	The conservation and protection of natural resources in WA-32-L is considered in Section 10.5 as part of Woodside's proposed arrangements to address the requirement for long-term monitoring stated in NOPSEMA's *Section 572 Maintenance and Removal of Property* (2020) policy.
Direction 5 Make good, to the satisfaction of NOPSEMA, any damage to the seabed or subsoil in the title area caused by any person engaged or concerned in the operations authorised by the title within 12 months after the property referred to in direction 2 is removed.	Direction 5 is not applicable to this EP. Damage to the seabed will be identified and rectified as required in the Stybarrow Decommissioning and Field Management EP (BHPB-00SC-N000-003) and the Stybarrow Plug and Abandonment EP (BHPB-00SC-N000-0005).
Direction 6 a. Submit to NOPSEMA on an annual basis, until all directions have been met, a progress report detailing planning towards and progress with undertaking the actions required by directions 1, 2, 3, 4 and 5.	Direction 5 is not applicable to this EP. Arrangements to report to NOPSEMA on progress relating to Direction 833 are outlined in the Stybarrow Decommissioning and Field Management EP (BHPB-00SC-N000-0003) and the Stybarrow Plug and Abandonment EP (BHPB-00SC-N000-0005).

Direction Number	Relevant Sections of this EP
b. The report submitted under Direction 6(a) must be to the satisfaction of NOPSEMA and submitted to NOPSEMA no later than 31 December each year. c. Publish the report in the registered holders' website within 14 days of obtaining NOPSEMA satisfaction under Direction 6(a)	

Woodside has provided a description of the holistic overview of the decommissioning planning and execution process for the equipment in WA-32-L in Section 4.4.

1.8 Structure of the Environment Plan

The EP has been structured to reflect the requirements of the Environment Regulations, as outlined in Table 1-3.

Table 1-3: EP content requirements from the Environment Regulations and relevant sections of the EP demonstrating the requirements are met

Criteria for Acceptance	Content Requirements / Relevant Regulations	Elements	Section of the EP
Regulation 10A(a): *is appropriate for the nature and scale of the activity*	Regulation 13: *Environmental Assessment* Regulation 14: *Implementation strategy for the environment plan* Regulation 16: *Other information in the environment plan*	The principle of 'nature and scale' applies throughout the EP	Section 4 Section 5 Section 6 Section 7 Section 8
Regulation 10A(b): *demonstrates that the environmental impacts and risks of the activity will be reduced to as low as reasonably practicable* Regulation 10A(c): *demonstrates that the environmental impacts and risks of the activity will be of an acceptable level*	Regulation 13(1)–13(7): *13(1) Description of the activity* *13(2)(3) Description of the environment* *13(4) Requirements* *13(5)(6) Evaluation of environmental impacts and risks* *13(7) Environmental performance outcomes and standards* *Regulation 16(a)–16(c):* *A statement of the titleholder's corporate environmental policy* *A report on all consultations between the titleholder and any relevant person*	Set the context (activity and existing environment) Define 'acceptable' (the requirements, the corporate policy, relevant persons) Detail the impacts and risks Evaluate the nature and scale Detail the control measures – ALARP and acceptable	Section 1 Section 2 Section 4 Section 5 Section 6 Section 7 Section 8
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 Environmental Performance Standards Measurement Criteria	Section 8
Regulation 10A(e):	Regulation 14:	Implementation strategy, including:	Section 7 Section 10

Criteria for Acceptance	Content Requirements / Relevant Regulations	Elements	Section of the EP
includes an appropriate implementation strategy and monitoring, recording and reporting arrangements	*Implementation strategy for the environment plan*	• systems, practices, and procedures, • performance monitoring, • Oil Pollution Emergency Plan (OPEP) and scientific monitoring, and • ongoing consultation	OPEP not required – no credible hydrocarbon spill scenarios
Regulation 10A(f): *does not involve the activity or part of the activity, other than arrangements for environmental monitoring or for responding to an emergency, being undertaken in any part of a declared World Heritage property within the meaning of the EPBC Act*	Regulation 13 (1)–13(3): *13(1) Description of the activity* *13(2) Description of the environment* *13(3) Without limiting [Regulation 13(2)(b)], particular relevant values and sensitivities may include any of the following:* *(a) the world heritage values of a declared World Heritage property within the meaning of the EPBC Act* *(b) the national heritage values of a National Heritage place within the meaning of that Act* *(c) the ecological character of a declared Ramsar wetland within the meaning of that Act* *(d) the presence of a listed threatened species or listed threatened ecological community within the meaning of that Act* *(e) the presence of a listed migratory species within the meaning of that Act* *(f) any values and sensitivities that exist in, or in relation to, part or all of:* *(i) a Commonwealth marine area within the meaning of that Act; or* *(ii) Commonwealth land within the meaning of that Act.*	No activity, or part of the activity, undertaken in any part of a declared World Heritage property.	Section 5 Section 8
Regulation 10A(g): *(i) the titleholder has carried out the consultations required by Division 2.2A* *(ii) the measures (if any) that the titleholder has adopted, or proposes to adopt, because of the consultations are appropriate*	Regulation 11A: *Consultation with relevant authorities, persons and organisations, etc.* Regulation 16(b): *A report on all consultations between the titleholder and any relevant person*	Consultation in preparation of the EP	Section 6
Regulation 10A(h):	Regulation 15:	All contents of the EP must comply with the	Section 1.9

Criteria for Acceptance	Content Requirements / Relevant Regulations	Elements	Section of the EP
complies with the Act and the regulations	*Details of the Titleholder and liaison person* Regulation 16(c): *Details of all reportable incidents in relation to the proposed activity.*	*Offshore Petroleum and Greenhouse Gas Storage Act 2006* and the Environment Regulations	

1.9 Titleholder Details

The nominated Titleholder for this activity is Woodside Energy (Australia) Pty Ltd.

In accordance with Regulation 15(1) of the Environment Regulations, details of the titleholder are provided in Table 1-4.

Table 1-4: Titleholder details

Name	Woodside Energy (Australia) Pty Ltd
Business address	11 Mount St, Perth, Western Australia 6000
Telephone number	1800 442977
Email address	katherin.domansky@woodside.com
Australian Company Number	006 923 879

In accordance with Regulation 15(2) of the Environment Regulations, details of the titleholder's nominated liaison person are provided in Table 1-5.

In the event of any change in the titleholder, titleholder parent company, a change in the titleholder's nominated liaison person or a change in the contact details for either the titleholder or the liaison person, Woodside will notify NOPSEMA in writing in accordance with Regulation 15(3) of the Environment Regulations

Table 1-5: Titleholder's nominated liaison person

Name	Steve Jeffcote
Position	Regional HSE Lead
Business address	11 Mount St, Perth, Western Australia 6000
Telephone number	+61 476 665 847
Email address	steve.jeffcote@woodside.com

2 Legislative Framework

2.1 International Conventions and Agreements

2.1.1 London Convention and London Protocol

The Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter 1972, referred to as the London Convention, is an international agreement to control pollution of the sea by dumping. It was updated by the 1996 Protocol to the Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter, 1972, referred to as the London Protocol. Australia is a signatory to the London Convention and the London Protocol. The *Environment Protection (Sea Dumping) Act 1981* (Section 2.2.3) gives effect to the London convention and London Protocol in Australian offshore waters.

The petroleum activity in this EP includes abandonment *in situ* of equipment – a wellhead, foundations and anchors embedded in the seabed. Abandonment *in situ* of equipment is consistent with the definition of sea dumping in the London Convention and London Protocol – i.e., the deliberate disposal at sea of man-made structures. The equipment to be abandoned *in situ* consists primarily of steel. Annex 1 of the London Protocol states that bulky items primarily comprising steel may be dumped at sea where practicable access to other disposal options are not available. Dumping of materials permitted by Annex 1 are subject to a permitting process, which is implemented by the *Environment Protection (Sea Dumping) Act 1981* in Australian offshore waters.

Woodside has identified that the recovery of the equipment to be abandoned *in situ* may feasibly be fully removed, however full removal is not practicable due to:

- The mass and size of the equipment
- The degree to which the equipment is embedded in the seabed – the foundations and anchors are intended to provide secure attachment points for infrastructure – and the associated disturbance to the seabed to remove the equipment
- The water depth and remoteness of the equipment location

2.1.2 United Nations Convention on the Law of the Sea

Article 60 of the 1982 United Nations Convention on the Law of the Sea (UNCLOS), to which Australia is a party, states:

"Any installations or structures which are abandoned or disused shall be removed to ensure safety of navigation, taking into account any generally accepted international standards established in this regard by the competent international organization. Such removal shall also have due regard to fishing, the protection of the marine environment and the rights and duties of other States."

The IMO is regarded as the competent organization to deal with the requirement of Article 60 of the UNCLOS.

Following UNCLOS, the IMO published Resolution A.672(16) Guidelines and Standards for the Removal of Offshore Installations and Structures on the Continental Shelf and in the Exclusive Economic Zone (IMO 1989). This resolution recognises that structures on the continental shelf should be removed, but coastal states (such as Australia) may make decisions to leave structures partially or completely in the sea.

2.2 Commonwealth Legislation

Environmental aspects of petroleum activity in Commonwealth waters are controlled by three main statutes, the *Offshore Petroleum and Greenhouse Gas Storage Act 2006* (OPGGS Act), the EPBC Act and the *Sea Dumping Act*. Each of these, as applicable to the petroleum activity, is described in the next sections. There are also applicable Commonwealth and Western Australian legislation, International Agreements and Conventions and other applicable standards, guidelines, and codes that may apply to the petroleum activities. These are listed in Appendix B of this EP.

2.2.1 Offshore Petroleum and Greenhouse Gas Storage Act 2006

The OPGGS Act provides the regulatory framework for all offshore exploration and production activities in Commonwealth waters (those areas beyond three nautical miles from the Territorial sea baseline and in the Commonwealth Petroleum Jurisdiction Boundary). The Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations (referred to as the Environment Regulations) have been made under the auspices of the OPGGS Act for the purposes of ensuring *"…any petroleum activity or greenhouse gas activity carried out in an offshore area is:*

- *carried out in a manner consistent with the principles of ecologically sustainable development set out in section 3A of the EPBC Act*
- *carried out in a manner by which the environmental impacts and risks of the activity will be reduced to as low as reasonably practicable*
- *carried out in a manner by which the environmental impacts and risks of the activity will be of an acceptable level".*

This EP meets the requirements of the Environment Regulations by providing a plan that:

- is appropriate for the nature and scale of the activity
- demonstrates the environmental impacts and risks of the activity will be reduced to as low as reasonably practicable
- demonstrates the environmental impacts and risks of the activity will be of an acceptable level
- provides for appropriate environmental performance outcomes, environmental performance standards and measurement criteria
- includes an appropriate implementation strategy and monitoring, recording and reporting arrangements
- does not involve the activity or part of the activity, other than arrangements for environmental monitoring or for responding to an emergency, being performed in any part of a declared World Heritage property within the meaning of the EPBC Act
- demonstrates that:
  - an appropriate level of consultation, as required by Division 2.2A, has been performed
  - the measures (if any) adopted, or proposed to adopt, because of consultations are appropriate
  - complies with the OPGGS Act and the Environment Regulations.

The OPGGS Act and supporting regulations address licensing, health, safety and environmental matters for offshore petroleum and gas exploration and production operations in Commonwealth waters. Obligations in relation to the maintenance and removal of equipment and property brought onto title are provided in OPGGS Act section 572. Section 572 requires the maintenance of property until it is removed, and removal of property when it is no longer used. NOPSEMA may accept alternatives to full removal if a titleholder demonstrates that the alternative yields equal or better environmental outcomes to full removal (NOPSEMA, 2020).

All Stybarrow subsea infrastructure in WA-32-L will be removed before 31 March 2025, in accordance with section 572(3) of the OPGGS Act, unless NOPSEMA accepts and is satisfied that an alternative decommissioning approach delivers equal or better environmental, safety and well integrity outcomes compared to complete removal.

2.2.1.1 General Direction 833

NOPSEMA issued General Direction 833, made under the OPGGS Act, to the titleholders of WA-32-L. The General Direction is available on NOPSEMA's website at https://www.nopsema.gov.au/sites/default/files/2021-09/A781218.pdf and is summarised, along with Woodside's intentions to address it, in Table 1-2. General Direction 833

2.2.1.2 Section 572 Maintenance and Removal of Property Policy

NOPSEMA's *Section 572 Maintenance and Removal of Property* (2020) policy required titleholders to maintain their property and remove it from a title area when it is no longer in use. The policy permits titleholders to propose

deviations to full removal. NOPSEMA will apply the following principles when considering EPs proposing alternatives to full removal (2020):

- An EP must meet the criteria for acceptance under the Environment regulations
- An EP must demonstrate that a deviation delivers equal or better environmental outcomes compared to complete property removal
- Property must be maintained so that it can be removed while planning for any deviations takes place
- Planning towards the proposed end-state for property above the seabed must be supported by information appropriate for the current state of the activity and include justified timeframes
- While approval for deviations are being pursued and the necessary planning progressed, titleholder submissions must recognise that unless deviations are approved at that point in time, complete property removal is the requirement.

This EP proposes abandonment *in situ* of a historical wellhead, the DTM anchors and suction piles described in Section 4 as an alternative to full removal. The environmental outcomes of this alternative compared to full removal are described in Section 3.

2.2.1.3 Section 270 NOPSEMA Advice - Consent to Surrender Title Policy

NOPSEMA's *Section 270 NOPSEMA Advice - Consent to Surrender Title* (2021) policy outlines the advice that the Joint Authority may seek from NOPSEMA when considering applications to surrender petroleum titles. The criteria in Section 270 of the OPGGS Act upon which NOPSEMA will base their advice includes whether:

- The registered holder of the permit, lease or licence has complied with the provisions contained in Chapter 6 of the OPGGS Act and in the regulations made under the OPGGS Act
- The registered holder of the permit, lease or licence has, to the satisfaction of NOPSEMA, removed or caused to be removed from the surrender area all property brought into the surrender area by any person engaged or concerned in the operations authorised by the permit, lease or licence; or made arrangements that are satisfactory to NOPSEMA in relation to that property
- The registered holder of the permit, lease or licence has, to the satisfaction of NOPSEMA, plugged or closed off all wells made in the surrender area by any person engaged or concerned in the operations authorised by the permit, lease or licence
- The registered holder of the permit, lease of licence has provided, to the satisfaction of NOPSEMA, for the conservation and protection of the natural resources in the surrender area
- The registered holder of the permit, lease or licence has, to the satisfaction of NOPSEMA, made good any damage to the seabed or subsoil in the surrender area caused by any person engaged or concerned in the operations authorised by the permit, lease or licence.

Woodside intends to apply to surrender the WA-32-L title following acceptance of this EP, the Stybarrow Decommissioning and Field Management EP (BHPB-00SC-N000-003) and the Stybarrow Plug and Abandonment EP (BHPB-00SC-N000-0005). Once their activities have been completed, these EPs will demonstrate to NOPSEMA that the above points have been addressed.

2.2.2 Environment Protection and Biodiversity Conservation Act 1999

The EPBC Act aims to protect and manage nationally and internationally important flora, fauna, ecological communities, and heritage places in Australia. These are defined in the Act as Matters of National Environmental Significance (MNES). NOPSEMA, through the Streamlining Offshore Petroleum Environmental Approvals Program, implements these requirements with respect to offshore petroleum activity in Commonwealth waters. The Streamlining Offshore Petroleum Environmental Approvals Program is applicable to all offshore petroleum activity authorised by the OPGGS Act and requires the petroleum activity to be conducted in accordance with an accepted EP, consistent with the principles of ecologically sustainable development (ESD). The definition of 'environment' in the Streamlining Offshore Petroleum Environmental Approvals Program is consistent with that used in the EPBC Act and encompass all matters protected under Part 3 of the EPBC Act.

Under Section 268 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 activity in Commonwealth waters, the above is implemented by NOPSEMA. Commitments relating to listed threatened species and ecological communities under the Act are included in the Program Report (Government of Australia, 2014):

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

Recovery and management plans relevant to this EP are outlined in Section 9.

2.2.3 Environment Protection (Sea Dumping) Act 1981

The *Environment Protection (Sea Dumping) Act 1981* (Sea Dumping Act) gives effect to Australia's obligations under the London Convention and the London Protocol. The *Sea Dumping Act* aims to protect and preserve the marine environment from all sources of marine pollution, and to prevent, reduce and eliminate pollution by controlling the dumping of wastes and other materials at sea. The *Sea Dumping Act* regulates the dumping at sea of controlled material (including certain wastes and other matter), the incineration at sea of controlled material, loading for the purpose of dumping or incineration, export for the purpose of dumping or incineration, and the placement of artificial reefs. Permits are required to authorise sea dumping activities.

The *Sea Dumping Act* and associated sea dumping permits are administered by the Department of Climate Change, Energy, the Environment and Water (DCCEEW) (formerly the Department of Agriculture, Water and Environment (DAWE)). The abandonment *in situ* of the equipment within the scope of this EP will require sea dumping permits. This is been confirmed with DCCEEW, as outlined in the summary of consultations in Section 6.

2.3 Environmental Guidelines, Standards and Codes of Practice

Several guidelines, standards and codes of practice are relevant to environmental management of the petroleum activity. These are listed in Appendix B.

3 Decommissioning Alternatives Assessment

3.1 Regulatory Context

Article 60 of the 1982 United Nations Convention on the Law of the Sea (UNCLOS), to which Australia is a party, states:

"Any installations or structures which are abandoned or disused shall be removed to ensure safety of navigation, taking into account any generally accepted international standards established in this regard by the competent international organization. Such removal shall also have due regard to fishing, the protection of the marine environment and the rights and duties of other States."

Australia is a member state of the International Maritime Organization (IMO), a body created by agreement of member states of the United Nations. The IMO is regarded as the competent organization to deal with the requirement of Article 60 of the UNCLOS. Following UNCLOS, the IMO published *Resolution A.672(16) Guidelines and Standards for the Removal of Offshore Installations and Structures on the Continental Shelf and in the Exclusive Economic Zone* (IMO, 1989). This resolution recognises that structures on the continental shelf should be removed, but coastal states (such as Australia) may make decisions to leave structures partially or completely in the sea.

Section 572 of the OPGGS Act requires that titleholders maintain their property and remove their property from a petroleum title area when it is no longer in use, which is consistent with the requirement of Article 60 of UNCLOS. However, the Commonwealth recognises that removal of property may not be feasible, or may result in environmental, safety and economic outcomes that are worse than leaving property in the sea. The *Offshore Petroleum Decommissioning Guideline* (Department of Industry, Science, Energy and Resources, 2022) outlines the Commonwealth's principles on decommissioning property used for offshore oil and gas exploration and production:

- Decommissioning is the responsibility of the titleholder
- Early planning for decommissioning is encouraged
- Complete removal of property is the base case
- Decommissioning must be completed before the end of the title

Noting these principles, the *Offshore Petroleum Decommissioning Guideline* (Department of Industry, Science, Energy and Resources, 2022) states that NOPSEMA may consider alternatives complete removal. The guideline requires a titleholder to demonstrate that any proposed alternatives to full removal must result in equal or better environmental, safety and well integrity outcomes compared to full removal.

The *Section 572 Maintenance and Removal of Property* (NOPSEMA, 2020) policy outlined NOPSEMA's position on Section 572 of the OPGGS Act and the *Offshore Petroleum Decommissioning Guideline* (Department of Industry, Science, Energy and Resources, 2022). This policy reinforces full removal of property is the base case for decommissioning and outlines NOPSEMA's position on alternatives to full removal of property. The policy requires that any EP proposing an alternative to full removal must include:

- An evaluation of the feasibility of all alternatives, including partial and complete removal of property
- An evaluation of environmental impacts and risks of all feasible alternatives, including complete property removal, to enable NOPSEMA to have regard to the Australian Government *Offshore Petroleum Decommissioning Guideline* (Department of Industry, Science, Energy and Resources, 2022) policy principle that deviations will provide an equal or better environmental outcome when compared to complete property removal. The evaluation of all the environmental impacts and risks of each alternative must include consideration of control measures necessary to manage the impacts and risks
- Evaluation of all environmental impacts and risks within Australia's environment including, where relevant, indirect consequences that may arise from the petroleum activity of removing property from a title area

- Where deviation/s to removal of property or relocation of property is proposed, titleholders are to address arrangements for long term monitoring and management. Environment plans requiring long-term monitoring for property will be subject to environmental performance reporting requirements and compliance monitoring by NOPSEMA for the duration of the monitoring program. NOPSEMA advises the Joint Authority of EPs requiring long term monitoring for property and this may be a matter taken into account when considering surrender of titles
- Consideration of relevant persons' consultation with respect to the alternatives being proposed

3.2 Decommissioning Alternatives Environmental Impact Assessment

Woodside has removed, or will remove, most of the equipment in the Stybarrow Field, as detailed in the Stybarrow Decommissioning and Field Management EP (BHPB-00SC-N000-003) and Stybarrow Plug and Abandonment EP BHPB-00SC-N000-0005). The decommissioning of the following equipment is not covered by these EPs, and Woodside are proposing the following equipment groups as candidates for abandonment *in situ*:

- DTM anchors
- Suction piles associated with:
  - Nine riser hold back bases
  - One water injection manifold foundation
- Wellheads:
  - One wellhead, Eskdale-1, where previous mechanical cutting attempts to remove the wellhead were unsuccessful

In accordance with NOPSEMA's *Section 572 Maintenance and Removal of Property* (NOPSEMA, 2020) policy, Woodside identified two feasible decommissioning alternatives for the equipment listed above. These alternatives are summarised in Table 3-1. The implementation of these alternatives assumes controls are implemented to manage environmental impacts and risks that are consistent with industry good practice.

Table 3-1: Feasible decommissioning alternatives for abandonment *in situ* candidate equipment groups

Equipment Group	Full Removal	Abandonment *In Situ*
DTM anchors	Feasible – excavate and pull anchor from seabed.	Feasible – leave as is following equipment removal campaign (i.e., mooring legs removed, embedded in seabed).
Suction piles	Feasible – reverse install and pull pile from seabed, excavation as required.	Feasible – leave as is following equipment removal campaign (i.e., attached equipment removed, embedded in seabed).
Wellheads	Feasible – mechanical cut within the wellhead below the mudline, with the wellhead then pulled from the seabed. Note – this has been previously attempted for Eskdale-1, without success.	Feasible – leave as is. Note – Eskdale 1 was an exploration well, no Christmas tree was installed.

Each of the feasible decommissioning alternatives for the candidate equipment groups has a range of different environmental, safety, technical, cost, and socio-economic outcomes. The *Section 572 Maintenance and Removal of Property* policy (NOPSEMA, 2020) requires that Woodside evaluate the environmental impacts and risks of the feasible decommissioning alternatives listed above. Woodside did this by undertaking a decommissioning alternatives environmental impact assessment (EIA), which is provided as Appendix E. The results are summarised in this section. The EIA used the analytic hierarchy process (AHP). An AHP analysis was developed for each equipment group to determine the relative impacts of each of the feasible decommissioning alternatives on

environmental values and sensitivities that may credibly be impacted. Refer to Appendix E for a description of the AHP methodology and detailed results.

The EIA considered the environmental impacts of the feasible decommissioning alternatives on the following environmental receptors:

- Sediment quality
- Water quality
- Benthic habitats
- Marine fauna
- Greenhouse gases
- Onshore environmental receptors
- Other users

The EIA determined the relative weightings for each of these environmental receptors. Then the EIA compared the environmental performance of the feasible decommissioning options for each equipment group within each of these environmental receptors. Refer to Appendix E for details on how the relative weightings for the environmental receptors and decommissioning alternatives were determined.

The EIA did not explicitly consider risks (i.e., impacts that may occur due to accidents or emergencies) to environmental values and sensitivities. The risk profile of each of the feasible decommissioning alternatives is broadly similar, with risks generally arising from vessel-based activities (e.g., introductions of invasive marine species and hydrocarbon spills). Woodside has a proven ability to prevent vessel-based risks becoming realised, and hence the environmental risk profiles of the feasible alternatives were not considered to differentiate the feasible decommissioning alternatives.

For all candidate equipment groups, the abandonment *in situ* alternative was clearly the most preferred alternative when assessed within the environmental receptors considered. Important considerations in the EIA that contribute to this result include:

- The candidate equipment groups are deeply embedded in the seabed and would require substantial seabed disturbance to recover
- The materials in the candidate equipment groups will result in negligible environmental impacts
- The risk of interactions between the candidate equipment groups and trawled fishing gear is negligible
- The absence of third-party activities in the Stybarrow field that may interact with the equipment

Summary results of the relative weightings for the feasible alternatives for the DTM anchors, suction piles and wellhead are shown in Figure 3-1, Figure 3-2 and Figure 3-3 respectively. The demonstration in the decommissioning alternatives EIA satisfies the requirement in the *Section 572 Maintenance and Removal of Property* (NOPSEMA, 2020) policy that any alternatives to full removal must result in equal or better environmental outcomes compared to full removal.

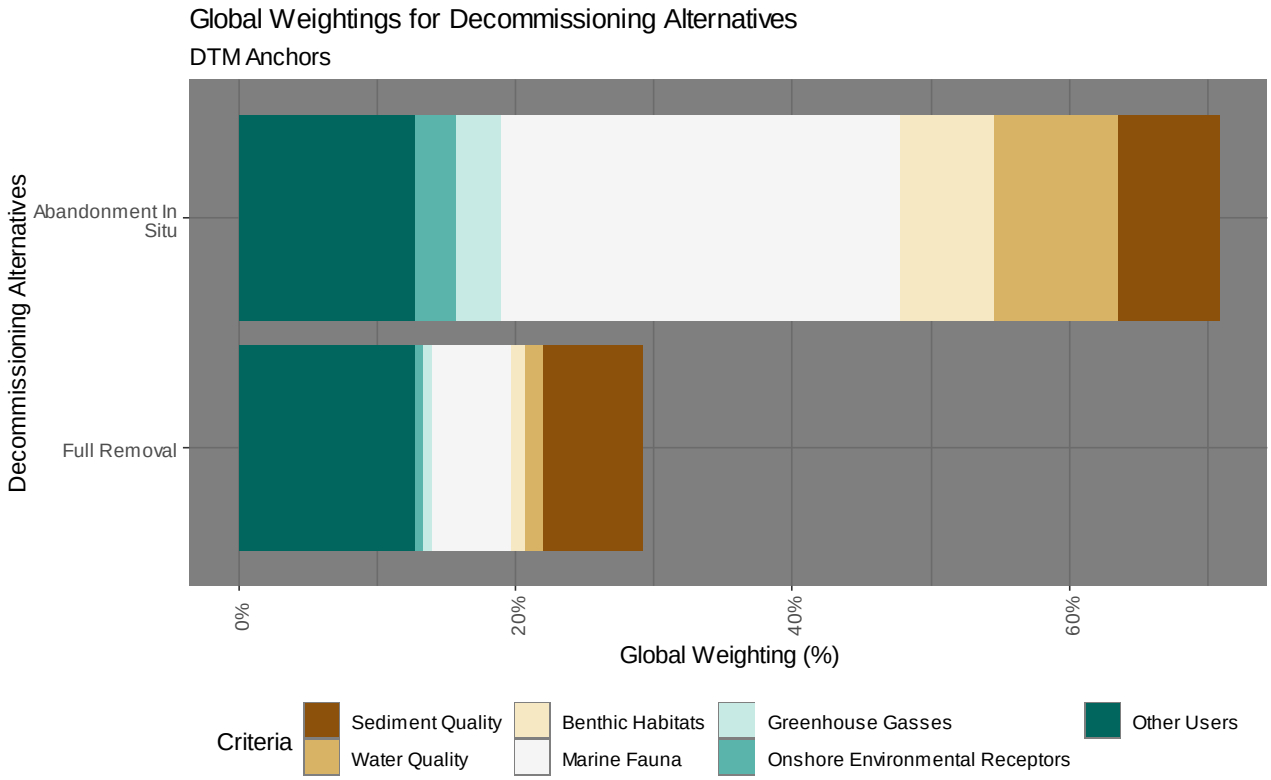

Figure 3-1: Stacked bar plots of weightings within each criterion for the DTM anchors feasible decommissioning alternatives

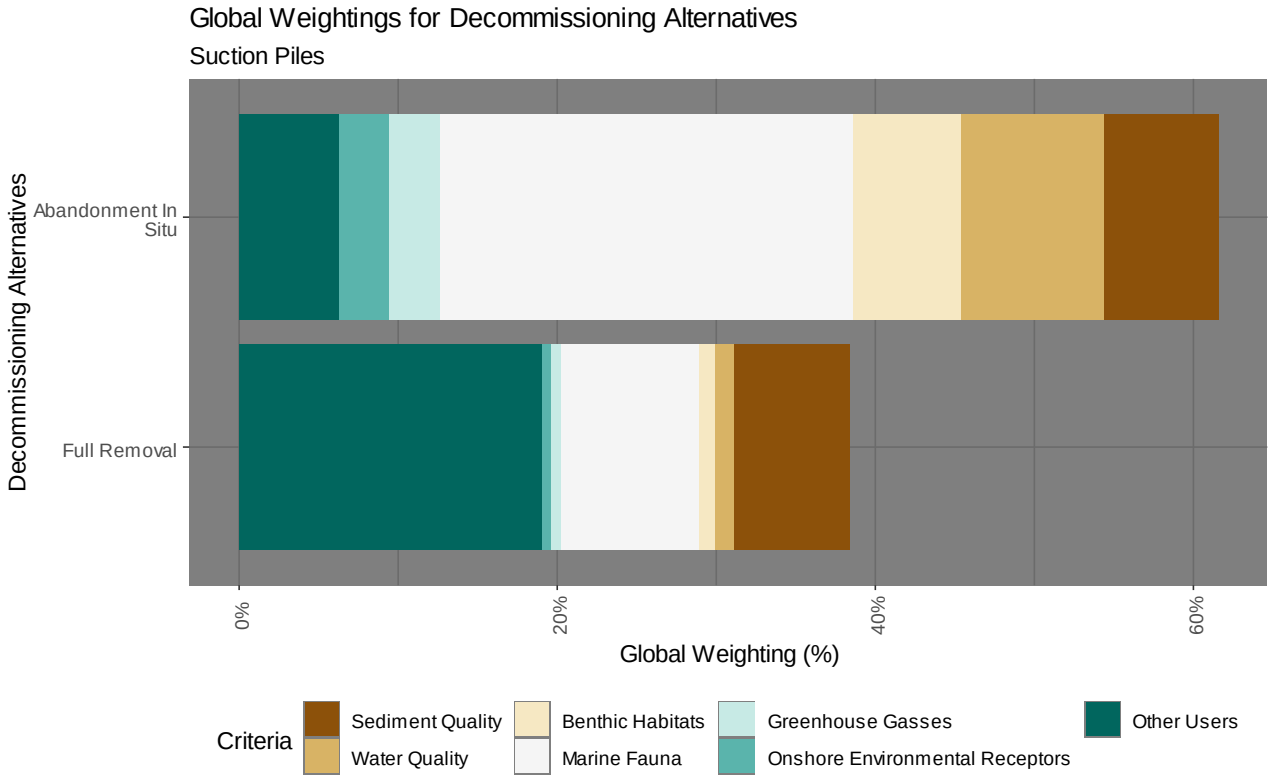

Figure 3-2: Stacked bar plots of weightings within each criterion for the suction piles feasible decommissioning alternatives

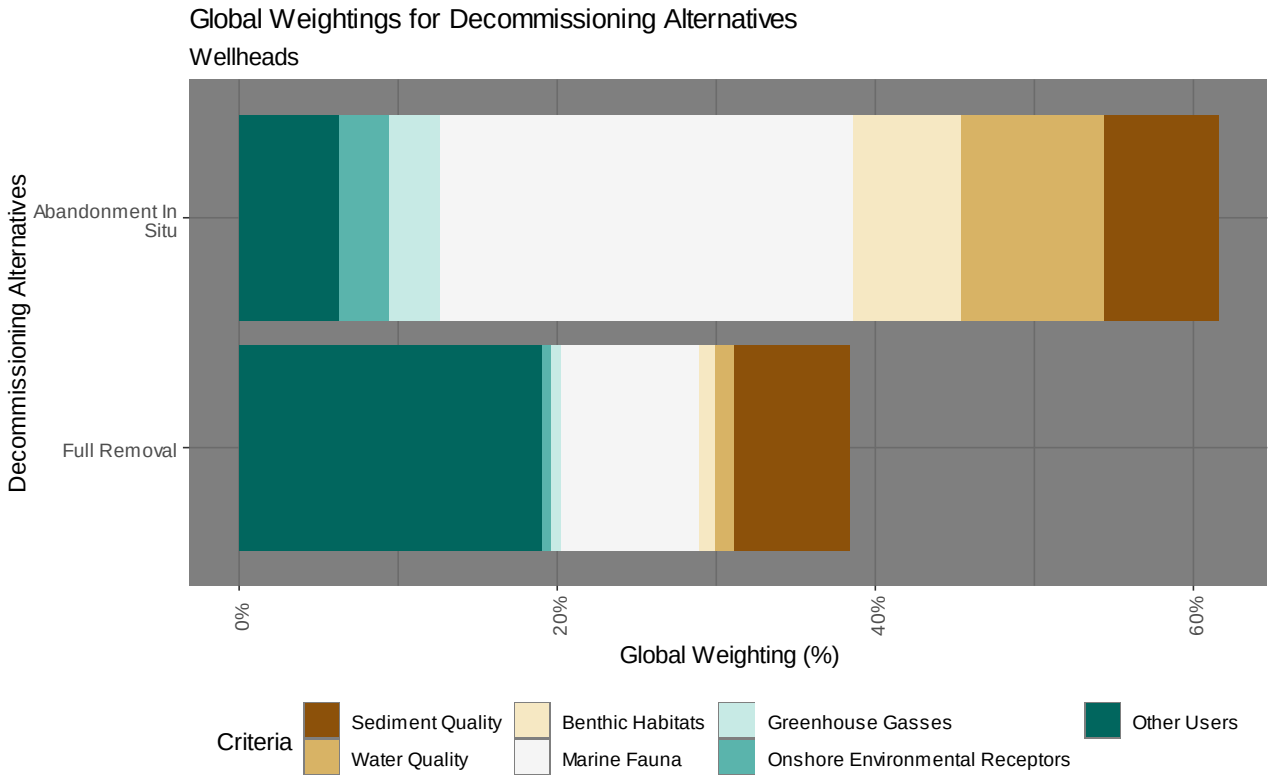

Figure 3-3: Stacked bar plots of weightings within each criterion for the wellheads feasible decommissioning alternatives

4 Description of the Activity

4.1 Overview

This section has been prepared in accordance with Regulation 13(1) of the Environment Regulations, and describes the petroleum activity to be performed under this EP.

When in production, the Stybarrow field comprised the MV16 Stybarrow Venture, a floating production, storage, and offloading (FPSO) vessel, with production, gas injection and water injection wells at four drill centres routed to the disconnectable turret mooring (DTM) via flexible flowlines. Oil products were stabilised and stored for offloading via tanker.

The Stybarrow field ceased production in June 2015. Since then, the following cessation activities have been completed:

- all flowlines and gas lift lines were flushed and filled with treated seawater and production flowlines disconnected.
- all production, gas injection and water injection wells were shut in and capped to await plugging and abandonment.
- the Stybarrow Venture FPSO was disconnected from the DTM and demobilised from the field.

The DTM unexpectedly sunk to the seabed at some point between May 2016 and October 2016, where it lies in approximately 825 m water depth with risers still attached. Following the DTM sinking, the riser buoyancy modules were removed to eliminate any buoyant risk.

Within the scope of this EP, Woodside proposes to abandon *in situ* equipment embedded in the seabed, namely:

- nine anchors for the DTM
- suction piles:
  - nine suction piles used as bases for holdback clamps on the risers
  - one suction pile used as the foundation for the water injection manifold
- wellheads:
  - one exploration wellhead, Eskdale-1, drilled in 2003, where previous attempts to remove the wellhead were unsuccessful

A detailed inventory of subsea infrastructure to be abandoned *in situ* under the scope of this EP is provided in Table 4-2.

Other activities relevant to the decommissioning of the Stybarrow field are covered in other EPs:

- Management and removal of most of the subsea equipment in the Stybarrow field, addressed in Stybarrow Decommissioning and Field Management EP (BHPB-00SC-N000-003)
- Plug and abandonment of shut-in wells in the Stybarrow field and removal of the H4 flowline, addressed in the Stybarrow Plug and Abandonment EP (BHPB-00SC-N000-0005)

An as-left survey to confirm the position and condition of the equipment will be done as part of the equipment removal activities addressed in the Stybarrow Decommissioning and Field Management EP (BHPB-00SC-N000-003).

4.2 Location of the Activity

The Stybarrow field is located within Production Licence WA-32-L, located in Commonwealth waters, around 56 km north-west of Exmouth, Western Australia and in water depths of about 810 m – 850 m (Figure 4-2).

The nearest point of the operational area to mainland shore is about 37 km (near the tip of North West Cape). The relative distances of key islands/mainland from the closest point in the operational area are provided in Table 4-1.

Table 4-1: Distance from operational area to key islands and mainland features

Key Island or Mainland Feature	Distance and Direction from Operational Area
Ningaloo World Heritage Area	24 km south
Muiron Islands	52 km east-south-east
Exmouth	56 km south-south-east
Serrurier Island	84 km east
Thevenard Island	115 km east
Onslow	130 km east
Barrow Island	163 km east-north-east

4.3 Timing of the Activity

Woodside proposes the petroleum activity is considered to have been completed once the environmental performance standards within the EP have been met and reported upon to NOPSEMA.

Further details on the scheduling of the Stybarrow field decommissioning is provided in the Stybarrow Decommissioning and Field Management EP (BHPB-00SC-N000-0003).

4.4 Holistic Stybarrow Field Decommissioning and Timing

4.4.1 Decommissioning planning

Decommissioning planning for the Stybarrow facilities removal is underway, with scope of work and tender/contract documents in a mature state.

Figure 4-1 provides an overview of the schedule of activities, including regulatory permissioning submissions and timing of key activities. It includes the contingent removal of the field equipment proposed to be left *in situ*, in the event the Deviation EP for it to remain *in situ* is not accepted and its removal is directed.

The activities being undertaken to meet the requirements of Section 572 and General Direction 833 are covered by three separate Environment Plans. The scope of each is detailed in Figure 4-1.

- Stybarrow field equipment, addressed in Stybarrow Decommissioning and Field Management EP (BHPB-00SC-N000-003):
  - Removal of DTM, moorings, flexible flowlines, wellheads, trees and ancillary subsea equipment
- Stybarrow Plug and Abandonment EP (BHPB-00SC-N000-0005):
  - Details the plug and abandonment of the 10 wells in the Stybarrow field.
- Stybarrow End State Decommissioning EP (BHPB-00SC-N000-0007) (this document):
  - Details a leave *in situ* deviation case for anchors, suction piles and a historical wellhead unable to be removed following historical P&A. This EP does not include a contingent removal option for these items.

The Field Management and Decommissioning EP is the overarching permissioning document under which the decommissioning requirements of General Direction 833 are captured. It is anticipated to remain in force until such time that all activities are complete, and the Petroleum title can be relinquished.

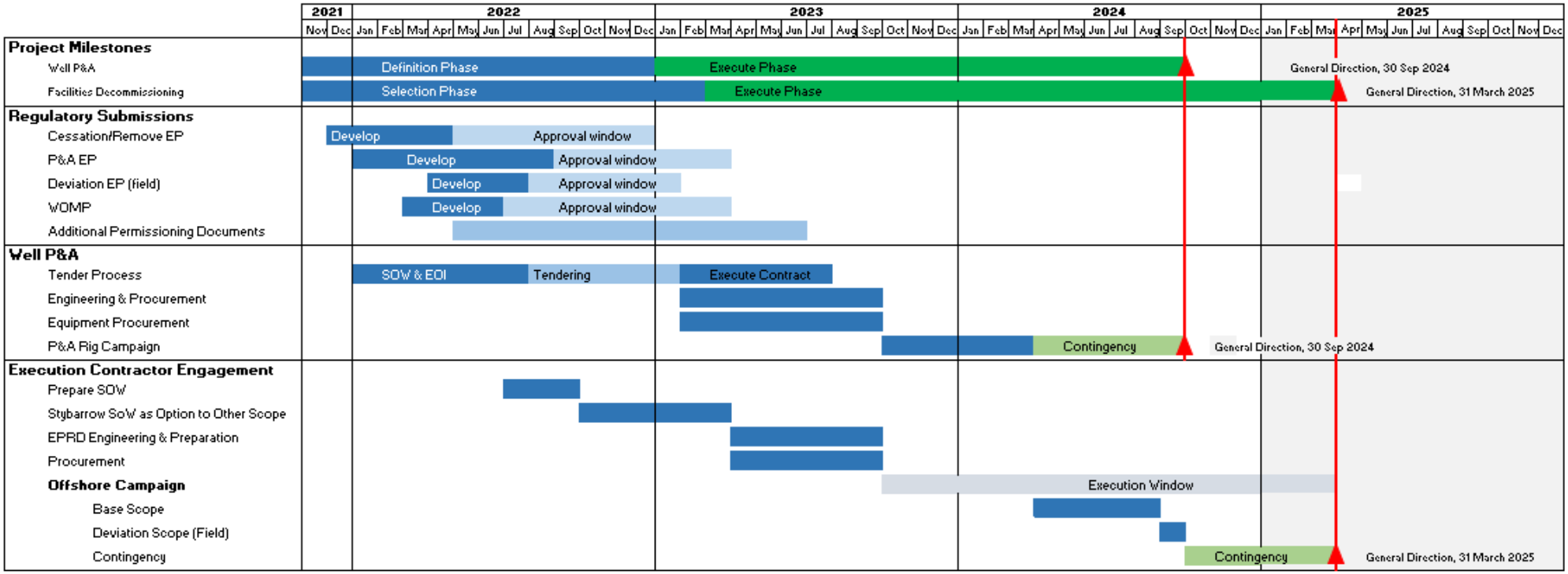

Figure 4-1: Indicative schedule for submission of permissioning documents and planning for Stybarrow field decommissioning

4.4.2 Surveys or Studies Undertaken to Support the Decommissioning Program

A baseline environmental survey was conducted in 2018 to inform background levels of contaminants in the sediment and water column. These survey results will be utilised as a comparison basis for the post removal environmental survey. ROV surveys have also been completed to inform the equipment condition and removal methods.

Plastics analysis on the flexible flowlines have been undertaken. All plastics are being removed.

Future work planned includes an ROV survey of equipment. This will inform the as-left condition of the equipment to support Sea Dumping Permit applications for equipment proposed to remain *in situ*.

Future work relating to the P&A campaign or the facilities equipment removal is detailed in the Well P&A EP and Decommissioning and Field Management EP respectively.

4.5 Operational Area

The operational area shown in Figure 4-2 is the spatial boundary of the petroleum activity, defined by the impacts and risks assessed and managed by this EP. The operational area includes the area encompassing a 1,500 m radius around the equipment that will be abandoned *in situ* within Commonwealth waters. All impacts and risks from the petroleum activity will be limited to within the operational area.

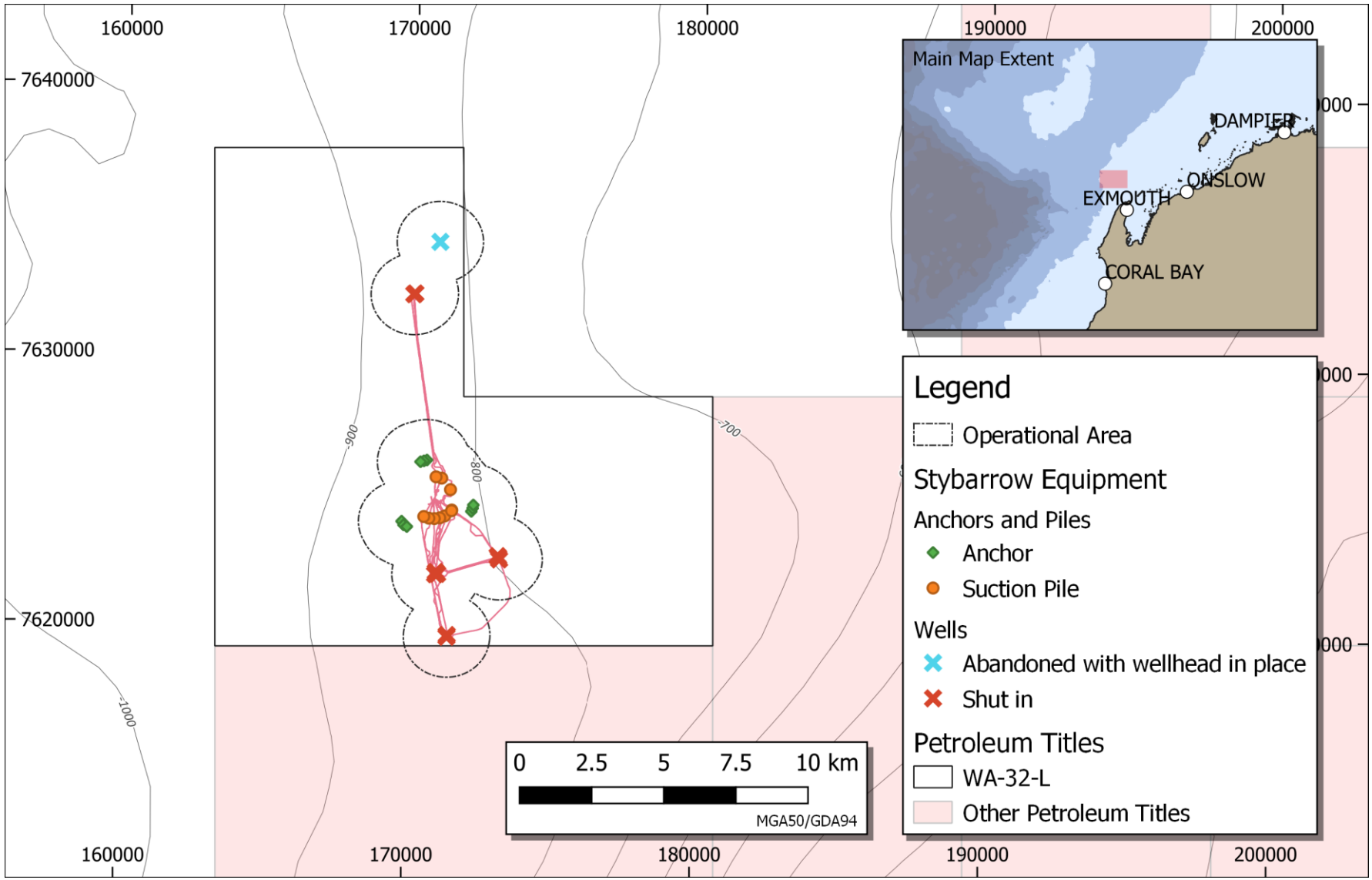

Figure 4-2: Location of the petroleum activity and operational area

4.6 Overview of Equipment to be Abandoned *In Situ*

All equipment to be abandoned *in situ* within the Stybarrow field is presented within Table 4-2, along with the status and condition. The locations of the field infrastructure is presented in Figure 4-2.

The equipment to be abandoned *in situ* is composed of steel and protective paint coatings. None of the equipment to be abandoned *in situ* contained production fluids, hence there are no residual contaminants from the operational phase of the Stybarrow field (e.g., hydrocarbons, NORM, heavy metal contaminants originating from the reservoir etc.).

The equipment utilised during the production life of the facility (anchors, piles) is within the intended design life of 15 years.

Table 4-2: Summary of equipment to be abandoned *in situ* in the Stybarrow field

Subsea Infrastructure	Quantity / Length	Size	Status and Condition
DTM mooring anchors	9	Approx. 11 tonnes each	Embedded in seabed.
Riser hold back anchors (suction piles)	9	4 m diameter, 7 m height	Suction piles embedded in seabed.
Water injection manifold piled foundation (suction pile)	1	7.83 m x 6.42 m	Suction pile foundation embedded in seabed.
Eskdale-1 wellhead	1	Approx. 2 m x 2 m x 3 m	Plugged and abandoned, embedded in seabed. Previous mechanical cutting attempts to remove were unsuccessful. The water depth precludes the use of abrasive water jet cutting techniques.

Since Stybarrow ceased production in 2015, the subsea infrastructure has been the subject of surveys to determine the status and condition of equipment and the environment. The inspection history of the subsea equipment over field life is summarised in Table 4-3.

Table 4-3: Inspection history of subsea equipment in the Stybarrow field

Date	Inspection / Survey Description
August 2009	ROV general visual inspection (GVI) and cathodic protection (CP) measurements of all subsea equipment
February 2010	ROV GVI of DTM and top 80 m of risers
July 2010	ROV inspection of mooring system
November 2011	ROV hull and mooring inspection
July 2012	ROV inspection and remediation of the Eskdale subsea distribution unit
July 2014	ROV GVI and CP measurements of all subsea equipment
October 2014	ROV GVI of EH-1 riser and bend stiffener
November 2014	ROV inspection of mooring legs and installing clamp on EH-1 riser
June 2015	ROV inspection of bend stiffener clamps

Date	Inspection / Survey Description
August 2015	Flushing and treating of flowlines and umbilicals, disconnection of DTM and departure of the FPSO
November 2015	Disconnection of production flowlines from wells
May 2016	Echo sounder of DTM (still at 40 m water depth)
October 2016	Echo sounder of DTM (not found)
November 2016	Multi-beam of DTM, confirmed DTM on seabed
December 2016	ROV GIV of DTM, risers and moorings
May 2017	Riser buoyancy modules removed
May 2018	Abandonment baseline survey consisting of GVI, NORM measurements, seabed and water sampling

The inspections are detailed in and supplemented by the following reports:

- Stybarrow Field (WA-32-L) Subsurface Handover Document (BHPB-00SC-A030-0001) (2015): a hand-over document by Woodside summarising the state of equipment following cessation of production.
- Stybarrow Field DTM Buoy, Risers and Moorings Survey (BHPB-00SC-T400-0004) (2016): a technical note by Woodside summarising an ROV inspection of the sunken DTM.
- Stybarrow Field ROV Inspection Survey Report (DOF1-00SC-R400-0002) (2017): a survey report by DOF Subsea summarising the observations of equipment in the Stybarrow field following sinking of the DTM.
- Stybarrow Infrastructure Status (00SD-BHPB-T40-0002) (2017): a report by Woodside summarising the inspections, and status, of the equipment in WA-32-L.
- Woodside Stybarrow Abandonment Project – Radiological Assessment (BHPB-00SC-R000-0006) (2018): a radiological assessment of naturally occurring radioactive materials (NORMs) within the subsea production equipment by SA Radiation. The report concluded NORMs were below the limits of detection in most of the equipment, with isolated areas of low-level NORMs contamination.
- Analysis of Sediment and Water Chemistry, Infauna, Epifauna and Fish in the Stybarrow Field (BHPB-00SC-R900-0001) (2019): an environmental survey within WA-32-L which indicated some localised elevated concentrations of metals in sediments around equipment.

The Stybarrow Decommissioning and Field Management EP (BHPB-00SC-N000-003) details the equipment that will be removed from the Stybarrow field, including:

- DTM
- DTM mooring legs – chain and wire (excluding anchors)
- Mooring support buoys
- Flexible risers
- Flexible production flowlines
- Gas injection / lift flowlines
- Water injection flowlines
- Umbilicals
- Wells (Xmas trees and wellheads)
- Jumpers
- Water injection manifold
- Subsea distribution units

- Umbilical termination assemblies
- Anode skids

Plug and abandonment activities of wells within the Stybarrow field are described in the Stybarrow Plug and Abandonment EP (Document number: BHPB-00SC-N000-0005)

4.6.1 Anchors

The steel mooring anchors are embedment-style anchors and are securely lodged in the seabed. Each anchor consists of flukes, a shank and a pad eye made of steel, and is coated in paint (Figure 4-3). Each anchor weighs approximately 11 tonnes. The positions of the anchors are provided in Table 4-2 and shown in Figure 4-3. Visual inspections indicate the anchors are completely buried, with no part of the anchors currently exposed above the seabed.

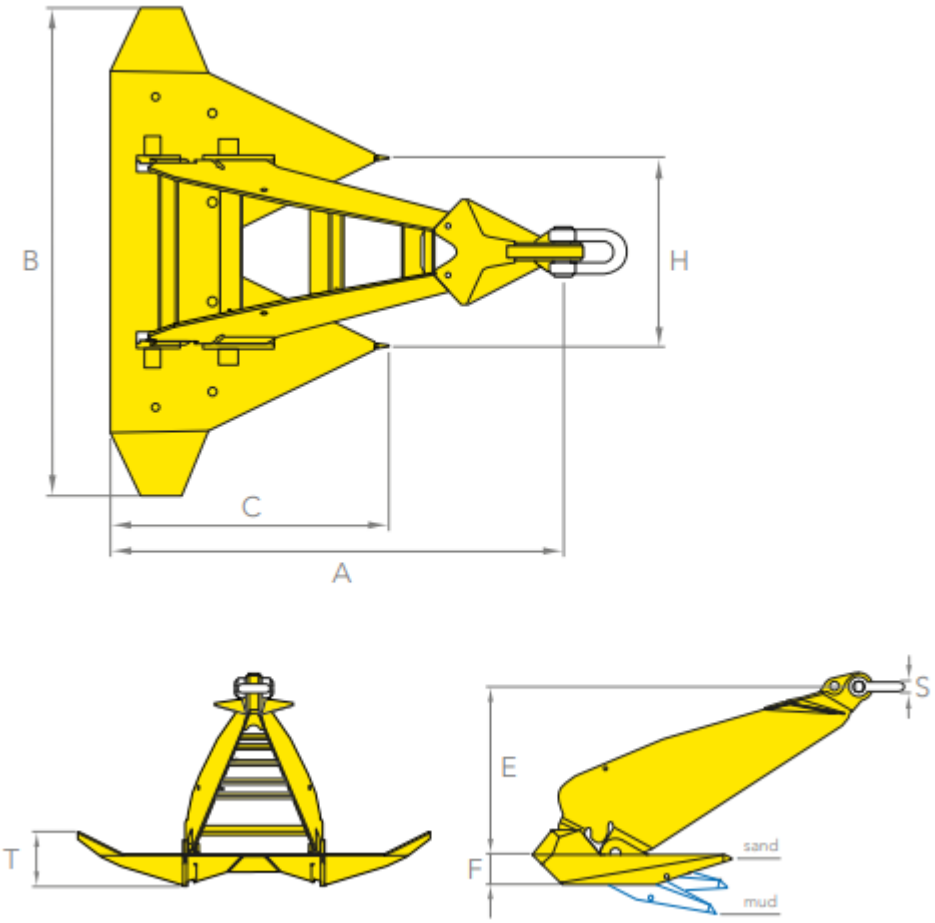

Figure 4-3: Design of embedment anchors used in the Stybarrow field

The mooring lines from the DTM to the anchors will be fully removed under the Stybarrow Decommissioning and Field Management EP (BHPB-00SC-N000-003).

Table 4-4: Anchor positions and depths (eastings and northings in MGA50/GDA94)

Mooring Leg Components	Easting (m)	Northing (m)	Depth (m)
Mooring 1 Anchor	172172.4	7624323.5	807.3
Mooring 2 Anchor	172215.2	7624441.7	807.5
Mooring 3 Anchor	172237.1	7624561.1	807.6

Mooring Leg Components	Easting (m)	Northing (m)	Depth (m)
Mooring 4 Anchor	170594.8	7626195.0	826.1
Mooring 5 Anchor	170489.2	7626161.1	829.1
Mooring 6 Anchor	170372.9	7626127.5	828.7
Mooring 7 Anchor	169759.4	7623909.3	842.4
Mooring 8 Anchor	169828.7	7623775.8	842.7
Mooring 9 Anchor	169943.1	7623715.9	842.0

4.6.2 Suction Piles

A series of nine suction piles are installed in the seabed, to which the risers are attached by holdback clamps. Each of these suction piles is approximately 7 m long and 4 m in diameter (Figure 4-4). The suction piles are securely embedded in the seabed. An additional suction pile is used as the foundation for the water injection manifold, which is approximately 7.83 m long and 6.42 m in diameter. All suction piles are made of low carbon steel, with trace amounts of alloying metals. Each pile has sacrificial anodes and a paint coating on the upper part of the pile intended to reduce corrosion. The majority of the pile surface embedded in the seabed, including the entire interior surface of the piles, was not painted in order to enhance friction between the pile and the seabed, resulting in greater holding capacity. Based on ROV footage, the suction piles protrude between 750-1,000 mm above the seabed.

The positions of the riser base and water injection manifold suction piles are provided in Table 4-5 and shown in Figure 4-2. All equipment attached to the suction piles, such as riser holdback clamps and the water injection manifold, will be removed prior to abandonment in situ.

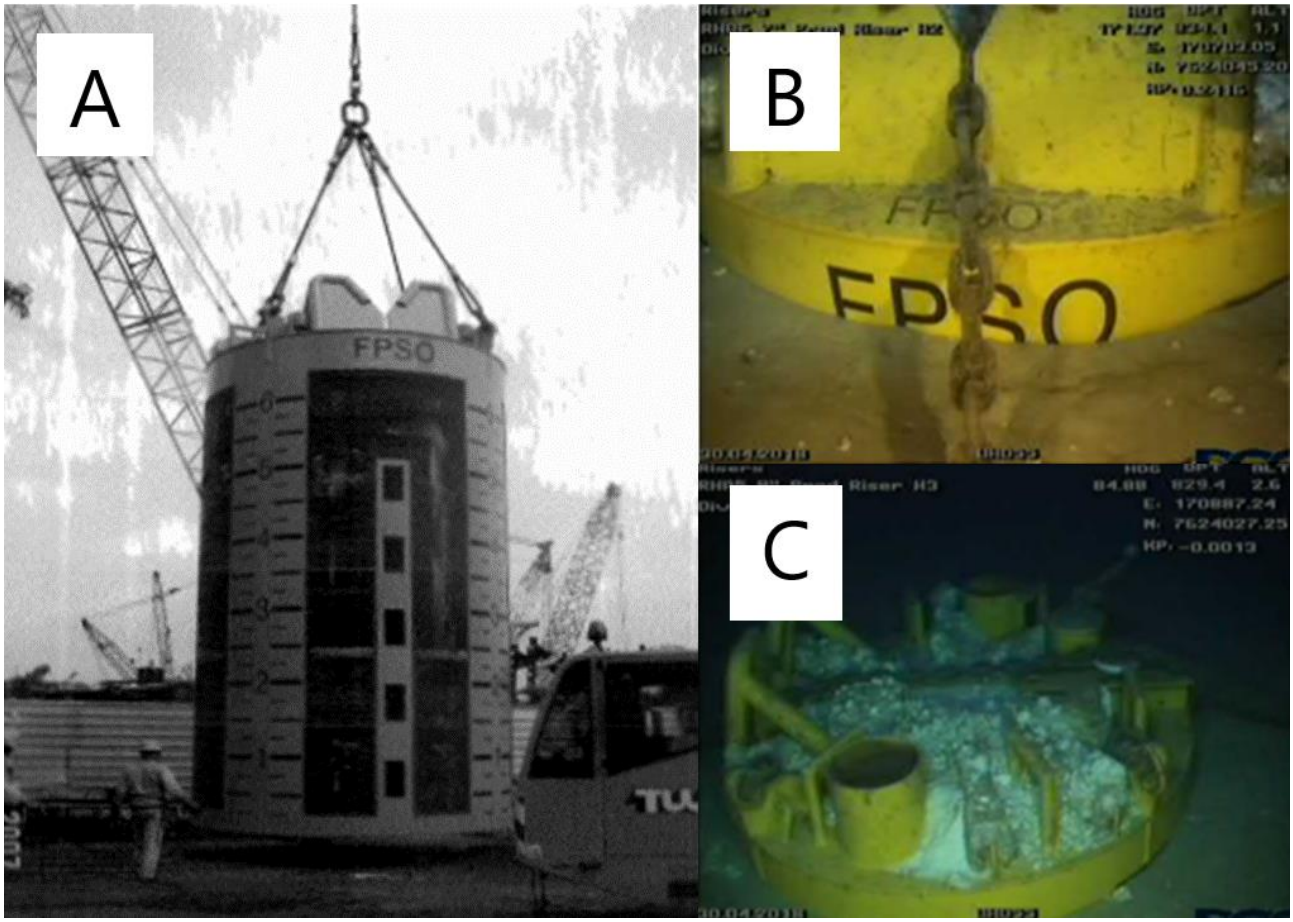

Figure 4-4: A riser holdback anchor suction pile prior to installation (A) and embedded in the seabed (B and C)

Table 4-5: Suction pile positions (eastings and northings in MGA50/GDA94)

Riser Bases	Easting	Northing
Dynamic Umbilical Riser Base	171433.8	7625113.9
Water Injection 10" Riser base	171491.8	7624359.1
H4GL Gas Lift 6" Riser Base	171256.2	7624136.9
EG1 Gas Injection 6" Riser Base	171121.0	7625533.9
H4 Production 8" Riser Base	171080.4	7624061.0
H3 Production 8" Riser Base	170894.3	7624028.6
H2 Production 7" Riser Base	170704.2	7624040.9
H1 Production 7" Riser Base	170526.5	7624100.2
EH1 Production 6" Riser Base	170921.2	7625578.0
Water Injection Manifold Suction Pile Foundation	171486.5	7624333.0

4.6.3 Wellheads

The wellheads are comprised of mild steel and may contain small quantities of synthetic materials (e.g., Teflon) within the seal component. Surface coatings have been used on the wellheads for corrosion protection. The wellheads typically extend between 2 m and 3 m above the mudline to facilitate installation of guide bases, blowout preventers and Christmas trees.

The Eskdale-1 exploration well was drilled by Woodside in 2003 and did not encounter commercially viable accumulations of hydrocarbons. The well was subsequently plugged and abandoned at the conclusion of the drilling program. The rig cut and attempted to recover the wellhead; repeated attempts were unsuccessful. Woodside subsequently informed the Western Australian Department of Industry and Resources (DOIR) (the administrator of the petroleum title at the time) that recovery of the wellhead was not feasible, and that Woodside intended to abandon the wellhead *in situ*. No records can be located to confirm that DOIR accepted the wellhead as-left status, hence it is included in the leave *in situ* scope. The release of fluids from the Eskdale-1 well below the cement plugs installed during plug and abandonment is not credible. The Eskdale-1 wellhead is uncapped.

All other wellheads (excluding Eskdale-1) are for shut in production or injection wells with Christmas trees in place, providing a barrier between the well and the environment. Woodside will remove the trees and wellheads either during plug and abandonment or equipment removal activities. Woodside has substantial experience in wellhead removal and is confident that these wellheads can be successfully removed below the mudline.

The contingent option of additional wellheads remaining *in situ* should they be unable to be removed is assessed in the Decommissioning Alternatives Environment Impact Assessment (Appendix E) but not carried through to the EP for wellheads other than that known to be unable to be removed (Eskdale-1).

The well within the scope of the assessment is listed in Table 4-6.

Table 4-6: Well positions (eastings and northings in MGA50/GDA94)

Drill Centre	Well	Easting (m)	Northing (m)
N/A	Eskdale-1	170896.58	7634287.20

5 Description of the Environment

The purpose of this section is to address the requirements of Regulation 13(2) and 13(3) of the Environment Regulations through describing the existing environment, including values and sensitivities that may be affected by both planned activities and unplanned events.

The description of the environment applies to the operational area – a 1,500 m buffer around the anchors and piles proposed to be abandoned *in situ*. All the environmental impacts and risks that may arise from the petroleum activities within the scope of this EP will be confined to within the operational area. Hence, the operational area constitutes the environment that may be affected by the petroleum activity.

A detailed and comprehensive description of the environment in the operational area and EMBA is provided in Appendix C.

5.1 Relevant Environmental Values and Sensitivities

Regulation 13(2) of OPGGS ((E) Regulations states that "*the environment plan must:*

- *13(2)(a) Describe the existing environment that may be affected by the activity; and*
- *13(2)(b) Include details of the particular relevant values and sensitivities (if any) of that environment*".

Regulation 13(3) of the OPGGS (E) Regulations states that "*Without limiting paragraph 13(2)(b), particular relevant values and sensitivities may include any of the following:*

- *13(3)(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*".

This section summarises environmental values and sensitivities, including physical, biological, socio-economic and cultural features in the marine and coastal environment that are relevant to the operational area and the EMBA. Searches for matters of national environmental significance (MNES) and other matters protected by the EPBC Act were undertaken for the operational area using the Protected Matters Search Tool (PMST).

A full description of the values and sensitivities relevant to the operational area is provided in Appendix C, along with the PMST Search Tool Report.

5.1.1 Bioregions

The operational area is located approximately 54 km north-west of Exmouth, Western Australia and within Commonwealth waters of the North West Marine Region. The EMBA overlaps the Northwest Provincial marine bioregion (Figure 5-1). Appendix C summarises the characteristics of this marine bioregion.

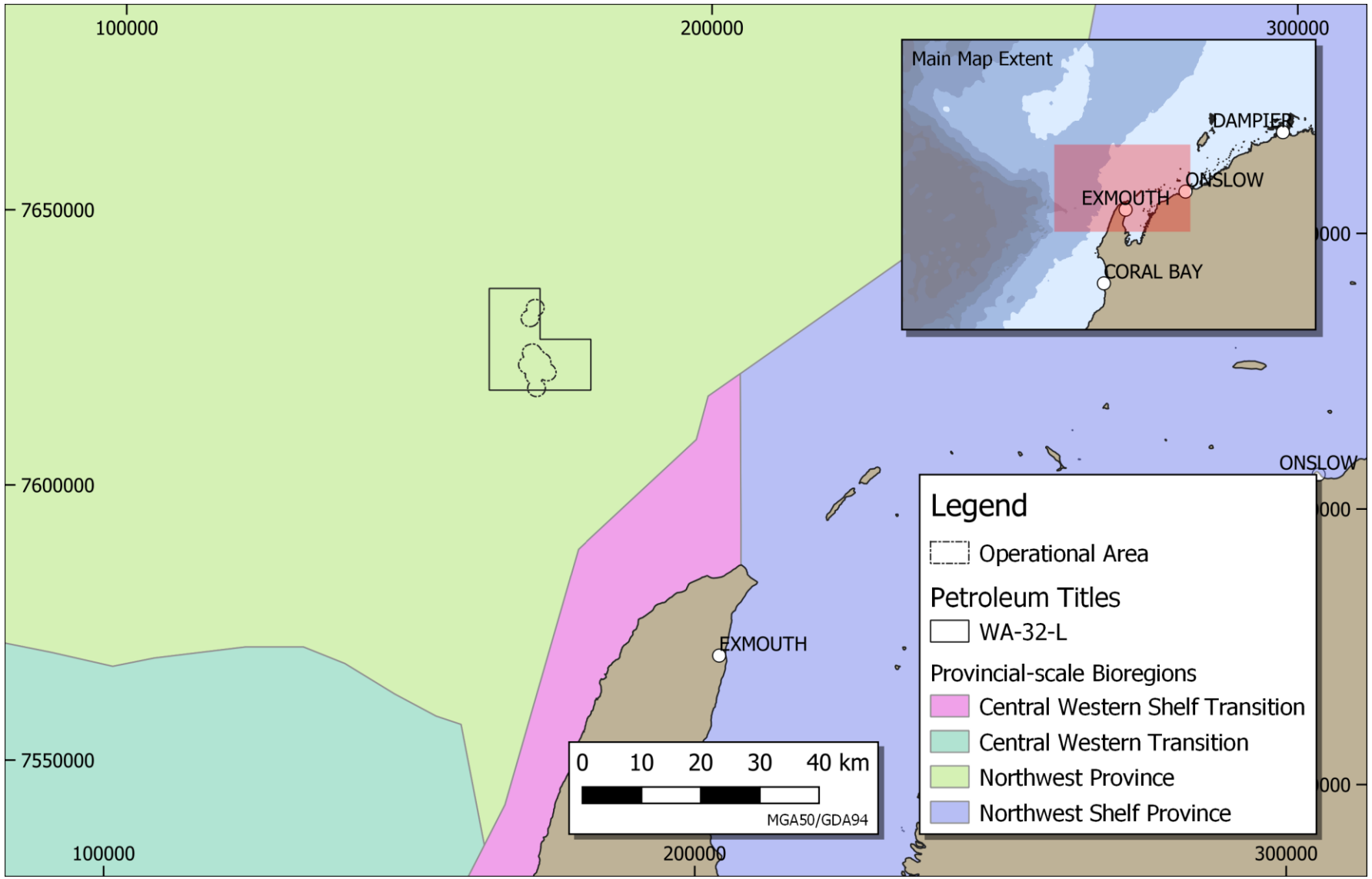

Figure 5-1: IMCRA 4.0 provincial bioregions in relation to the operational area

5.1.2 Matters of National Environmental Significance

Table 5-1 summarises the MNES identified as potentially occurring within the operational area determined by the PMST results (Appendix C).

Additional information on identified MNES are provided throughout this Section and in Appendix C, Section 2.4.

Table 5-1: Summary of MNES within operational area

MNES	Number	Relevant Section
World Heritage Properties	0	Not applicable
National Heritage Places	0	Not applicable
Wetlands of International Importance (Ramsar)	0	Not applicable
Marine Parks	0	Not applicable
Listed Threatened Ecological Communities	0	Not applicable
Listed Threatened Species[1]	20	Section 5.5.1
Listed Migratory Species[1, 2]	31	Section 5.5.1

Note 1 Terrestrial species (such as terrestrial mammals, reptiles, and bird species) that appear in the PMST results and do not have habitats along shorelines are not relevant to the petroleum activity impacts and risks and are not included in these numbers.

Note 2 The EPBC Act categorise migratory and threatened species independently, therefore migratory species can also be threatened.

5.2 Stybarrow Field Environmental Surveys

An environmental survey of the Stybarrow field (Cardno, 2019) was commissioned, the results of which are summarised below. Woodside commissioned a study of the canyon systems in the region (BMT Oceanica, 2016), which includes the Canyons linking the Cuvier Abyssal Plain and the Cape Range Peninsula Key Ecological Feature (KEF). One of the canyons constituting this KEF overlaps the operational area. Where relevant these studies have been referenced within this Section and throughout the EP.

5.3 Biological Environment

5.3.1 Sediments

Sampling by Cardno (2019) indicated that sediments within the Stybarrow field are characterised by silt-sized (3.9 mm to 62.5 µm) particles, which is typical of sediments in similar water depths in the region (Baker et al., 2008).

Analysis of potential contaminants in sediments indicated that concentrations of metals, radionuclides, and hydrocarbons within the Stybarrow field were generally not significantly higher than concentrations observed at reference sites. Elevated concentrations of some metals were observed at sites within the Stybarrow field – concentrations of lead, barium, boron, arsenic, and mercury were higher at some impacted sites within the field, although barium was the only metal in which concentrations between impact and reference sites was statistically significant (Cardno, 2019). Increased barium concentrations may be due to historical discharges of drilling fluids, which commonly contain barium sulphate (barite) as a weighting agent. Concentrations of lead, mercury and arsenic were above the default guideline values (DGVs) for sediment quality stated in the *Australian and New Zealand guidelines for Fresh and Marine Water Quality* (Commonwealth of Australia and New Zealand Government, 2018), although none exceeded the upper guideline values (GV-high) at which toxicity-related effects may be expected to be observed.

An environmental survey and literature review of canyons in the region by BMT Oceanica (2016) concluded the following:

- The seabed in most of the region is featureless with sediments dominated by silty clays. Outcropping rock and consolidated or coarser sediment habitats were otherwise minor components of the seabed.
- Large areas of soft ooze and fine mud sediments were observed between water depths of 600 to 900 m.
- The small particle size of the sediments may influence the diversity of infauna (Etter and Grassle, 1992), and the retention of contaminants (Burdige, 2006; Fukue et al., 2006), with finer particles potentially having a greater retention capacity.
- Metals were below Interim Sediment Quality Guidelines outlined in the *Australian and New Zealand Guidelines for Fresh and Marine Water Quality: Volume 1 - the Guidelines* (Australian and New Zealand Environment and Conservation Council and Agriculture and Resource Management Council of Australia and New Zealand, 2000)[1], which is similar to previous surveys at Enfield.

5.3.2 Benthic Habitats and Infauna

Cardno (2019) observed only unconsolidated sediment within WA-32-L, with no areas of hard substate (with the exception of the Stybarrow field equipment). Few epifauna and demersal or benthic fish were observed by Cardno (2019), which is consistent with similar deep-water habitats in the region, with heart urchins grenadier fish and decapods the most commonly observed taxa.

Infauna sampling by ROV cores yielded very few infauna at impact and control sites in WA-32-L, indicating low density but widely distributed infauna assemblages (Cardno, 2019). This is consistent with other surveys in the region (e.g., RPS, 2013).

An environmental survey and literature review of canyons in the region by BMT Oceanica (2016) concluded the following:

- The North and South Enfield Canyons are regarded as bathyal which is defined as 200-2,000 m, ~1% gravel, ~70% mud, ~5°C temperature at the seabed, and a 1° slope.
- Typical benthic habitats within the Enfield region was bare, unconsolidated, muddy, soft substrate and typically support sparse assemblages of filter and deposit-feeding epibenthic fauna.
- Outcropping rock and consolidated or coarser sediment habitats appeared to be minor components of the seabed.
- Distribution of biota was patchy, with crustaceans, molluscs, echinoderms, cnidarians and poriferans recorded. Motile scavengers were regarded as the dominant group including crabs and shrimps. Echinoderms were less abundant and consisted of ophiuroids, holothurians, echinoids and asteroids.

Two key ecological features (KEFs) occur within the operational area and are considered to be of regional importance for either a region's biodiversity or its ecosystem function and integrity:

- Continental Slope Demersal Fish Communities
- Canyons linking the Cuvier Abyssal Plain and the Cape Range Peninsula

A detailed description of these KEFs is provided in Appendix C.

5.3.3 Water Quality

Cardno (2019) sampled surface waters in WA-32-L and found no evidence of contaminants. Given the depth of the equipment in the Stybarrow field, it is very unlikely that water from near the seabed would mix to the surface. The deeper parts of the water column below the thermocline are typically poorly mixed compared to surface waters and hence form an extensive barrier between water at the seabed and water at the surface.

[1] Superseded by *Australian and New Zealand Guidelines for Fresh and Marine Water Quality* (Commonwealth of Australia and New Zealand Government, 2018)

5.4 Protected or Significant Areas

5.4.1 Key Ecological Features

Key ecological features (KEFs) are areas of regional importance for either biodiversity or ecosystem function and integrity within the Commonwealth marine environment and have been identified through the marine bioregional planning process.

Two KEFs were identified within the operational area:

- Continental Slope Demersal Fish Communities
- Canyons linking the Cuvier Abyssal Plain and the Cape Range Peninsula

A detailed description of these KEFs is provided in Appendix C.

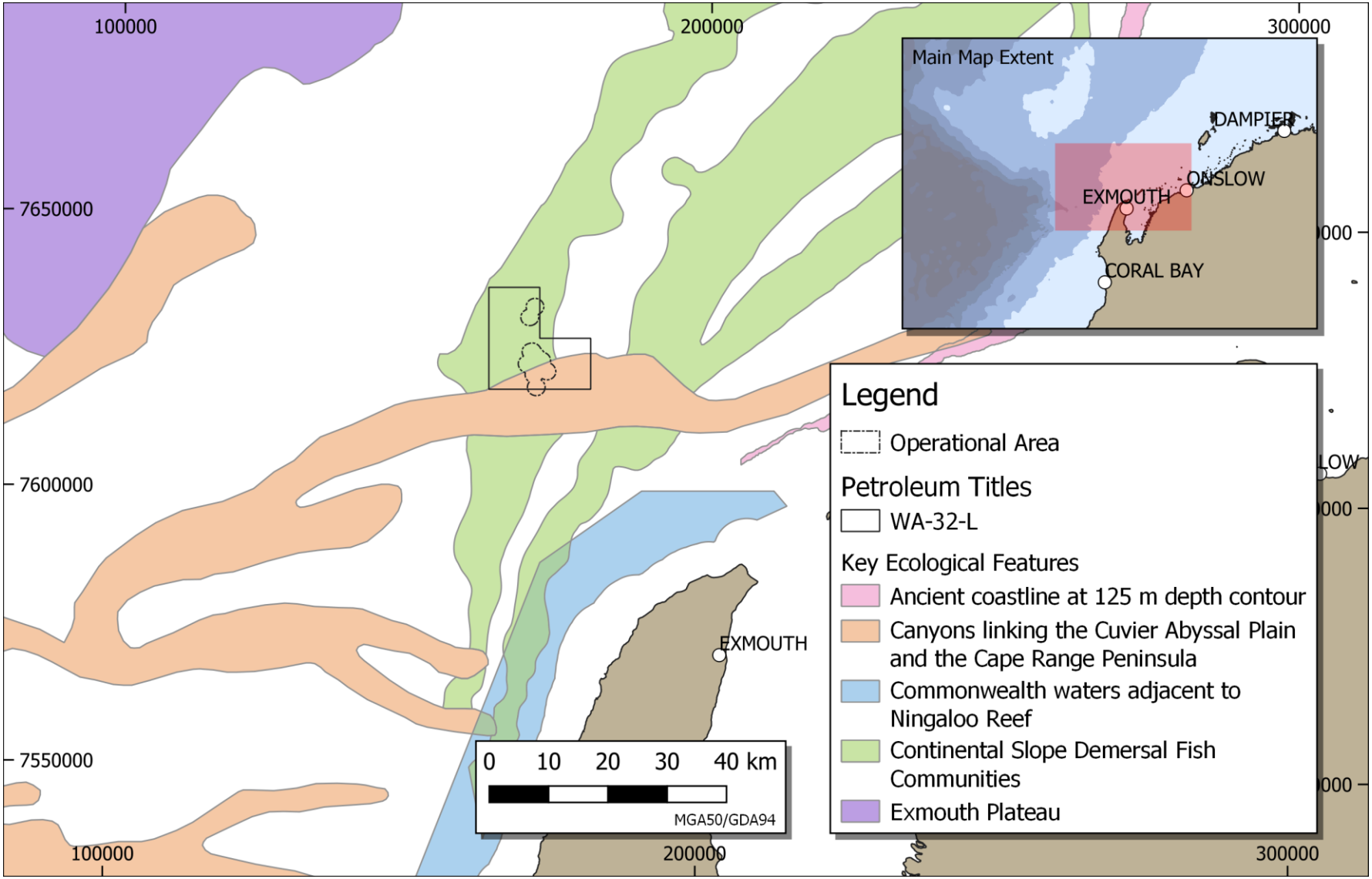

Figure 5-2: Key Ecological Features within the operational area

5.4.2 World Heritage Properties

World Heritage Properties represent the best examples of the world's cultural and natural heritage. There are no World Heritage Properties within the operational area.

5.4.3 National Heritage Properties

Australia's national heritage comprises exceptional natural and cultural places that contribute to Australia's national identity. There are no National Heritage Places within the operational area.

5.4.4 Commonwealth Heritage Properties

The Commonwealth Heritage List is a list of Indigenous, historic and natural heritage places owned or controlled by the Australian Government. There are no Commonwealth Heritage Places within the operational area.

5.4.5 Marine Protected Areas

There are no Australian or State Marine Parks located in the operational area.

5.5 Marine Fauna

5.5.1 Threatened and Migratory Species

Table 5-2 presents the threatened and migratory species within the operational area and the EMBA. These include all relevant MNES protected under the EPBC Act, as identified in the PMST search for the operational area and EMBA (PMST search results are provided in Appendix C, Attachment 1). For each species identified, the extent of likely presence is noted.

The PMST results identified 20 marine fauna species listed as `threatened' species and 31 marine fauna species listed as `migratory' within the operational area. A description of the identified threatened and migratory species is included in Appendix C, Sections 2.4 - 2.8.

Species with designated biologically important areas (BIAs) and Habitat Critical to their Survival (critical habitat) overlapping the EMBA and operational area have been identified in Section 5.5.2.

Table 5-2: Threatened and migratory species predicted to occur within the operational area and EMBA

Value/Sensitivity Common Name	Scientific Name	Threatened Status	Migratory Status	Sensitivities within Operational Area
Fish, Sharks and Rays				
Oceanic Whitetip Shark	*Carcharhinus longimanus*	-	Migratory	Species or species habitat may occur within area
White Shark, Great White Shark	*Carcharodon carcharias*	Vulnerable	Migratory	Species or species habitat may occur within area
Shortfin Mako, Mako Shark	*Isurus oxyrinchus*	-	Migratory	Species or species habitat likely to occur within area
Longfin Mako	*Isurus paucus*	-	Migratory	Species or species habitat likely to occur within area
Giant Manta Ray	*Mobula birostris*	-	Migratory	Species or species habitat likely to occur within area
Scalloped Hammerhead	*Sphyrna lewini*	Conservation Dependent	-	Species or species habitat may occur within area
Southern Bluefin Tuna	*Thunnus maccoyii*	Conservation Dependent	-	Species or species habitat likely to occur within area
Marine Mammals				
Antarctic Minke Whale, Dark-shoulder Minke Whale	*Balaenoptera bonaerensis*	-	Migratory	Species or species habitat likely to occur within area
Sei Whale	*Balaenoptera borealis*	Vulnerable	Migratory	Species or species habitat likely to occur within area
Bryde's Whale	*Balaenoptera edeni*	-	Migratory	Species or species habitat likely to occur within area
Blue Whale	*Balaenoptera musculus*	Endangered	Migratory	Migration route known to occur within area
Fin Whale	*Balaenoptera physalus*	Vulnerable	Migratory	Species or species habitat likely to occur within area
Southern Right Whale	*Eubalaena australis*	Endangered	Migratory[2]	Species or species habitat may occur within area
Humpback Whale	*Megaptera novaeangliae*	-	Migratory	Species or species habitat likely to occur within area
Killer Whale, Orca	*Orcinus orca*	-	Migratory	Species or species habitat may occur within area

[2] as *Balaena glacialis australis*

Value/Sensitivity Common Name	Scientific Name	Threatened Status	Migratory Status	Sensitivities within Operational Area
Sperm Whale	*Physeter macrocephalus*	-	Migratory	Species or species habitat may occur within area
Spotted Bottlenose Dolphin (Arafura/Timor Sea populations)	*Tursiops aduncus* (Arafura/Timor Sea populations)	-	Migratory	Species or species habitat may occur within area
Marine Reptiles				
Loggerhead Turtle	*Caretta caretta*	Endangered	Migratory	Species or species habitat known to occur within area
Green Turtle	*Chelonia mydas*	Vulnerable	Migratory	Species or species habitat known to occur within area
Leatherback Turtle, Leathery Turtle, Luth	*Dermochelys coriacea*	Endangered	Migratory	Species or species habitat known to occur within area
Hawksbill Turtle	*Eretmochelys imbricata*	Vulnerable	Migratory	Species or species habitat known to occur within area
Flatback Turtle	*Natator depressus*	Vulnerable	Migratory	Species or species habitat known to occur within area
Marine Birds				
Common Sandpiper	*Actitis hypoleucos*	-	Migratory	Species or species habitat may occur within area
Common Noddy	*Anous stolidus*	-	Migratory	Species or species habitat may occur within area
Sharp-tailed Sandpiper	*Calidris acuminata*	-	Migratory	Species or species habitat may occur within area
Red Knot, Knot	*Calidris canutus*	Endangered	Migratory	Species or species habitat may occur within area
Curlew Sandpiper	*Calidris ferruginea*	Critically Endangered	Migratory	Species or species habitat may occur within area
Pectoral Sandpiper	*Calidris melanotos*	-	Migratory	Species or species habitat may occur within area
Lesser Frigatebird, Least Frigatebird	*Fregata ariel*	-	Migratory	Species or species habitat may occur within area
Southern Giant-Petrel, Southern Giant Petrel	*Macronectes giganteus*	Endangered	Migratory	Species or species habitat may occur within area

Value/Sensitivity Common Name	Scientific Name	Threatened Status	Migratory Status	Sensitivities within Operational Area
Eastern Curlew, Far Eastern Curlew	*Numenius madagascariensis*	Critically Endangered	Migratory	Species or species habitat may occur within area
White-tailed Tropicbird	*Phaethon lepturus*	-	Migratory	Species or species habitat may occur within area
Christmas Island White-tailed Tropicbird, Golden Bosunbird	*Phaethon lepturus fulvus*	Endangered	-	Species or species habitat may occur within area
Soft-plumaged Petrel	*Pterodroma mollis*	Vulnerable	-	Species or species habitat may occur within area
Australian Fairy Tern	*Sternula nereis nereis*	Vulnerable	-	Foraging, feeding or related behaviour likely to occur within area
Indian Yellow-nosed Albatross	*Thalassarche carteri*	Vulnerable	Migratory	Species or species habitat may occur within area

5.5.2 Biologically Important Areas and Critical Habitats

Biologically important areas (BIAs) are those locations where aggregations of members of a species are known to undertake biologically important behaviours, such as breeding, resting, foraging or migration. BIAs have been identified using expert scientific knowledge about species abundance, distribution and behaviours. BIAs are not recognised by the EPBC Act but are identified by DAWE to aid in the management and protection of threatened fauna.

BIAs overlapping the operational area are:

- Pygmy blue whale migration
- Pygmy blue whale distribution
- Wedge-tailed shearwater breeding

Habitats critical for the survival of a species, referred to as critical habitats, are recognised under the EPBC Act. Critical habitats may be identified in species recovery plans made under the EPBC Act or listed on the register of critical habitat maintained by the minister under the EPBC Act. Woodside considers critical habitats carry greater weight than BIAs. No habitats critical for the survival of a species overlap the operational area.

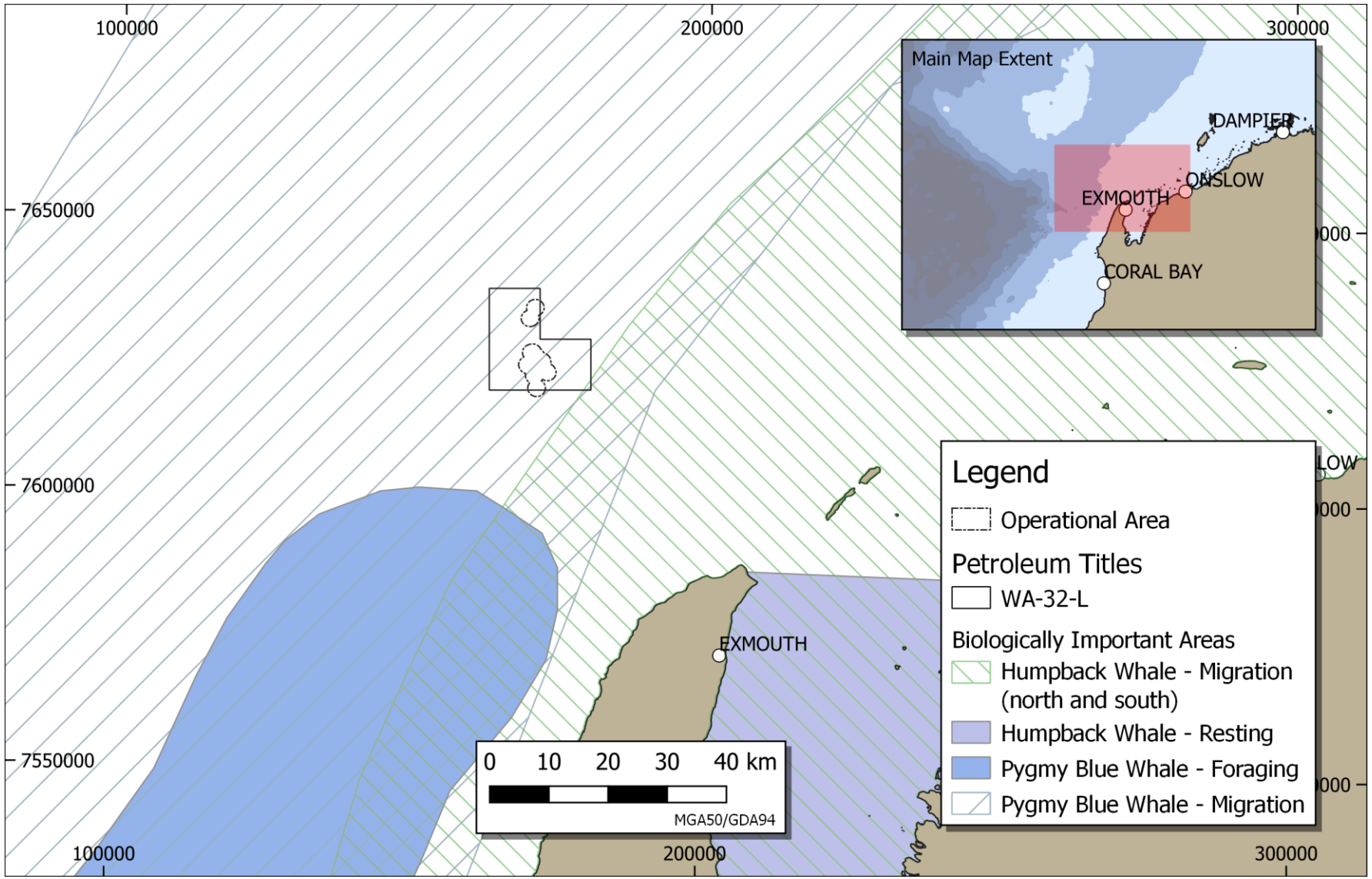

Figure 5-3: Whale biologically important areas within the operational area

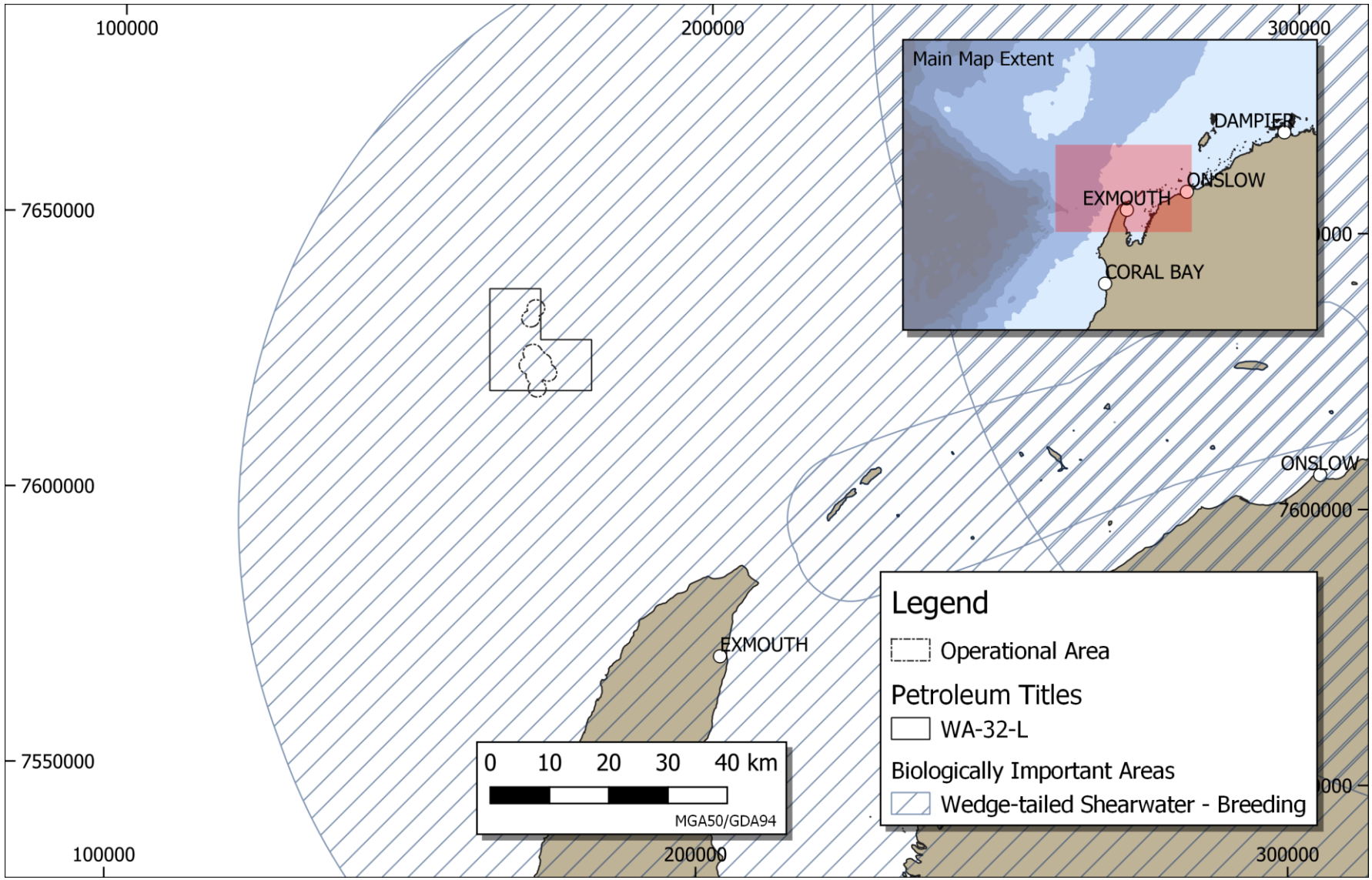

Figure 5-4: Wedge-tailed shearwater biologically important areas within the operational area

5.5.3 Species Recovery Plans, Conservation Advice and Threat Abatement Plans

Woodside considered recovery plans, conservation management plans, threat abatement plans or approved conservation advice in place for EPBC Act-listed threatened species that may potentially occur or use habitat within the EMBA (Table 5-3).

Recovery plans set out the research and management actions necessary to stop the decline of and support the recovery of listed threatened species. In addition, threat abatement plans provide for the research, management and any other actions necessary to reduce the impact of a listed key threatening process on native species and ecological communities. The Minister decides whether a threat abatement plan is required for key threatening processes listed under Section 183 of the EPBC Act. Table 5-3 provides information about the specific requirements of the relevant conservation advice, species recovery plans and threat abatement plans that applies to the petroleum activities, and demonstrates how current management requirements have been taken into account while preparing the EP. Through implementing relevant control measures, performance outcomes and performance standards, potential risks and impacts of the petroleum activities are managed to ALARP and acceptable levels.

Table 5-3 summarises the actions relevant to the petroleum activity, with more information about the specific requirements of the relevant plans of management (including Conservation Advice and Conservation Management Plans) applicable to the petroleum activity and demonstrates where management requirements have been addressed.

Table 5-3: Recovery plans, conservation advice and threat abatement plans relevant to the petroleum activity

Common Name	Recovery Plan / Conservation Advice / Management Plan	Threats identified that may Arise from the Petroleum Activity	Relevant EP Section
All Vertebrate Fauna			
All vertebrate fauna	Threat abatement plan for the impacts of marine debris on the vertebrate wildlife of Australia's coasts and oceans (Commonwealth of Australia, 2018)	No identified threats arising from petroleum activity	Not applicable
Fishes, Sharks and Rays			
White Shark, Great White Shark	Recovery Plan for the White Shark (*Carcharodon carcharias*) (Department of Sustainability, Environment, Water, Population and Communities, 2013)	No identified threats arising from petroleum activity	Not applicable
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, 2015)	No identified threats arising from petroleum activity	Not applicable
Sei Whale	Conservation Advice *Balaenoptera borealis* sei whale (Threatened Species Scientific Committee, 2015a)	No identified threats arising from petroleum activity	Not applicable
Fin Whale	Conservation Advice *Balaenoptera physalus* fin whale (Threatened Species Scientific Committee, 2015b)	No identified threats arising from petroleum activity	Not applicable
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 (Department of Sustainability, Environment, Water, Population and Communities, 2012)	No identified threats arising from petroleum activity	Not applicable
Marine Reptiles			
Loggerhead Turtle	Recovery plan for marine turtles in Australia 2017-2027 (Commonwealth of Australia, 2017)	No identified threats arising from petroleum activity	Not applicable

Common Name	Recovery Plan / Conservation Advice / Management Plan	Threats identified that may Arise from the Petroleum Activity	Relevant EP Section
Leatherback Turtle, Leathery Turtle, Luth	Recovery plan for marine turtles in Australia 2017-2027 (Commonwealth of Australia, 2017)	No identified threats arising from petroleum activity	Not applicable
	Approved conservation advice for *Dermochelys coriacea* (Leatherback Turtle) (Threatened Species Scientific Committee, 2008)	No identified threats arising from petroleum activity	Not applicable
Hawksbill Turtle	Recovery plan for marine turtles in Australia 2017-2027 (Commonwealth of Australia, 2017)	No identified threats arising from petroleum activity	Not applicable
Green Turtle	Recovery plan for marine turtles in Australia 2017-2027 (Commonwealth of Australia, 2017)	No identified threats arising from petroleum activity	Not applicable
Flatback Turtle	Recovery plan for marine turtles in Australia 2017-2027 (Commonwealth of Australia, 2017)	No identified threats arising from petroleum activity	Not applicable
Seabirds and Migratory Shorebirds			
Eastern Curlew, Far Eastern Curlew	Conservation Advice *Numenius madagascariensis* eastern curlew (Threatened Species Scientific Committee, 2015c)	No identified threats arising from petroleum activity	Not applicable
Curlew Sandpiper	Conservation Advice *Calidris ferruginea* curlew sandpiper (Threatened Species Scientific Committee, 2015d)	No identified threats arising from petroleum activity	Not applicable
Southern Giant-Petrel, Southern Giant Petrel	National recovery plan for threatened albatrosses and giant petrels 2011-2016 (Department of Sustainability, Environment, Water, Population and Communities, 2011)	No identified threats arising from petroleum activity	Not applicable
Red Knot, Knot	Conservation advice *Calidris canutus* red knot (Threatened Species Scientific Committee, 2016)	No identified threats arising from petroleum activity	Not applicable
Indian Yellow-nosed Albatross	National recovery plan for threatened albatrosses and giant petrels 2011-2016 (Department of Sustainability, Environment, Water, Population and Communities, 2011)	No identified threats arising from petroleum activity	Not applicable
Australian Fairy Tern	Conservation advice for *Sternula nereis nereis* (Fairy tern) (Threatened Species Scientific Committee, 2011)	No identified threats arising from petroleum activity	Not applicable

Common Name	Recovery Plan / Conservation Advice / Management Plan	Threats identified that may Arise from the Petroleum Activity	Relevant EP Section
Soft-plumaged Petrel	Conservation advice *Pterodroma mollis* soft-plumage petrel (Threatened Species Scientific Committee, 2015e)	No identified threats arising from petroleum activity	Not applicable

5.6 Socio-economic

Socio-economic activities that may occur within the operational area include commercial fishing, oil and gas exploration and production, and to a lesser extent, recreational fishing and tourism as summarised below.

More detailed descriptions of socio-economic considerations are provided in Appendix C, Section 2.10.

5.6.1 Commercial Fisheries

A number of Commonwealth and State fishery management areas overlap the operational area. Table 5-4 identifies the Commonwealth and State commercial fisheries overlapping the operational area and provides an assessment of the potential interaction based on the nature of the fishery and historic catch data.

Table 5-4: Commonwealth and state managed fisheries within the operational area and EMBA

Fishery Name	Potential Interaction?	Description[1]
Commonwealth Fisheries		
Western Deep Water Trawl Fishery	Yes	The Western Deepwater Trawl Fishery operates in Commonwealth waters off the coast of Western Australia. Effort in recent years has been localised in the area offshore and slightly south of Shark Bay. Catch in the 2019–20 season was 31 t in total. Whilst the operational area overlaps with the fishery management area, there is very little potential for interaction given the current distribution of target species and fishing effort.
Western Tuna and Billfish Fishery	No	Fishing effort has concentrated off south-west Western Australia, with occasional activity off South Australia. Whilst there is an overlap with the fishery management area, there is no potential for interaction given the current distribution of fishing effort.
Sothern Bluefin Tuna Fishery	No	Fishing effort has concentrated off southern and eastern Australia. Whilst there is an overlap with the fishery management area, there is no potential for interaction given the current distribution of fishing effort.
Skipjack Tuna Fishery	No	There has been no fishing in the since 2008–09. Whilst the operational area overlaps with the fishery management area, there is no potential for interaction given the current distribution of fishing effort.
State Fisheries		
Pilbara Crab Fishery	No	Blue swimmer crabs are targeted by the Pilbara Crab Managed Fishery using hourglass traps, primarily within inshore waters around Nickol Bay and Dampier. Water depths in the operational area too deep to support the target species and the fishery is not active in the operational area.
Pilbara Line Fishery	No	The Pilbara Line Fishery encompasses all of the 'Pilbara waters', extending from a line commencing at the intersection of 21°56'S latitude and the boundary of the Australian Fishing Zone and north to longitude 120°E. There are no stated depth limits of the fishery. The fishing vessels primarily target demersal Lutjanid species such as goldband snapper, which typically occur in < 200 m water depth. Given the depth preferences of target species, no fishing in this fishery will occur in the operational area.
West Coast Deep Sea Crustacean	Yes	The West Coast Deep Sea Crustacean Fishery is a 'pot' fishery using baited pots operated in a long-line formation in the shelf edge waters (> 150 m) of the West Coast and Gascoyne Bioregions. The fishery primarily targets crystal crabs. Water depths in the operational area are not conducive for this fishery.
Mackerel Fishery	No	The Mackerel Managed Fishery targets Spanish mackerel (*Scomberomorus commerson*) using near-surface trawling gear from small vessels in coastal areas around reefs, shoals and headlands. The commercial fishery extends from Geraldton to the Northern Territory border. No interaction is expected given the gear type, habitat preference for target species (pelagic) and known fishing effort.

Fishery Name	Potential Interaction?	Description[1]
Marine Aquarium	No	The Marine Aquarium Managed Fishery operates within Western Australian waters. The fishery is primarily a dive-based fishery that uses hand-held nets to capture the desired target species and is restricted to safe diving depths (typically < 30 m). The fishery is typically active from Esperance to Broome, with popular areas including the coastal waters of the Cape Leeuwin/Cape Naturaliste region, Dampier and Exmouth. Water depths in the operational area are not conducive for this fishery.
South West Coast Salmon	No	The commercial salmon fishery use beach seine net to catch fish. There are two commercial salmon fisheries operating in Western Australia: the South Coast Salmon Managed Fishery (18 licences) and South West Coast Salmon Managed Fishery (six licences). The target species is restricted to temperate waters and will not occur in the Gascoyne or Pilbara.

[1] Fisheries descriptions derived from *Fishery Status Reports 2021* (Patterson et al., 2021) and *Status Report of the Fisheries and Aquatic Resources of Western Australia 2018/2019 - State of the Fisheries* (Gaughan and Santoro, 2020) unless cited otherwise.

5.6.2 Traditional Fisheries

There are not expected to be any traditional fisheries that operate within the operational area.

5.6.3 Tourism and Recreation

While relatively close to the Ningaloo Coast, which supports extensive nature-based tourism, the operational area is in deep water (approximately 800 m) with no significant natural attractions and is a considerable distance from the nearest boat-launching facilities. Given the depth of the operational area and distance from shore, significant recreational fishing and tourism are not expected. Appendix C, Section 2.10.4 provides detail on recreational fishing and tourism in the region.

5.6.4 Oil and Gas Activities

The NWS is Australia's most prolific oil and gas production area, largely responsible for WA accounting for 66% of the country's oil production, 76% of the country's condensate production and 37% of the country's gas production in 2013 (Australian Petroleum Production and Exploration Association, 2014).

Oil and gas production facilities close to the operational area include:

- Woodside's Ngujima-Yin FPSO (approximately 16 km east of the operational area)
- Santos' Ningaloo Vision FPSO (approximately 19 km east of the operational area), and
- Woodside's Pyrenees Venture FPSO (approximately 21 km east-south-east of the operational area).

Woodside's Laverda field lies directly to the south of WA-32-L and is produced back to the Ngujima-Yin FPSO. The subsea equipment associated with the Laverda production is approximately 5 km from the operational area at the closest point.

5.6.5 Commercial Shipping

The operational area hosts very low levels of commercial shipping. A fairway designed by AMSA lies to the west and north of the operational area, approximately 26 km from the operational area at the closest point. Commercial shipping is concentrated within this fairway (Figure 5-5). The production facilities to the east of the operational area will intermittently host tankers for offtakes, however all these facilities lie well beyond the operational area.

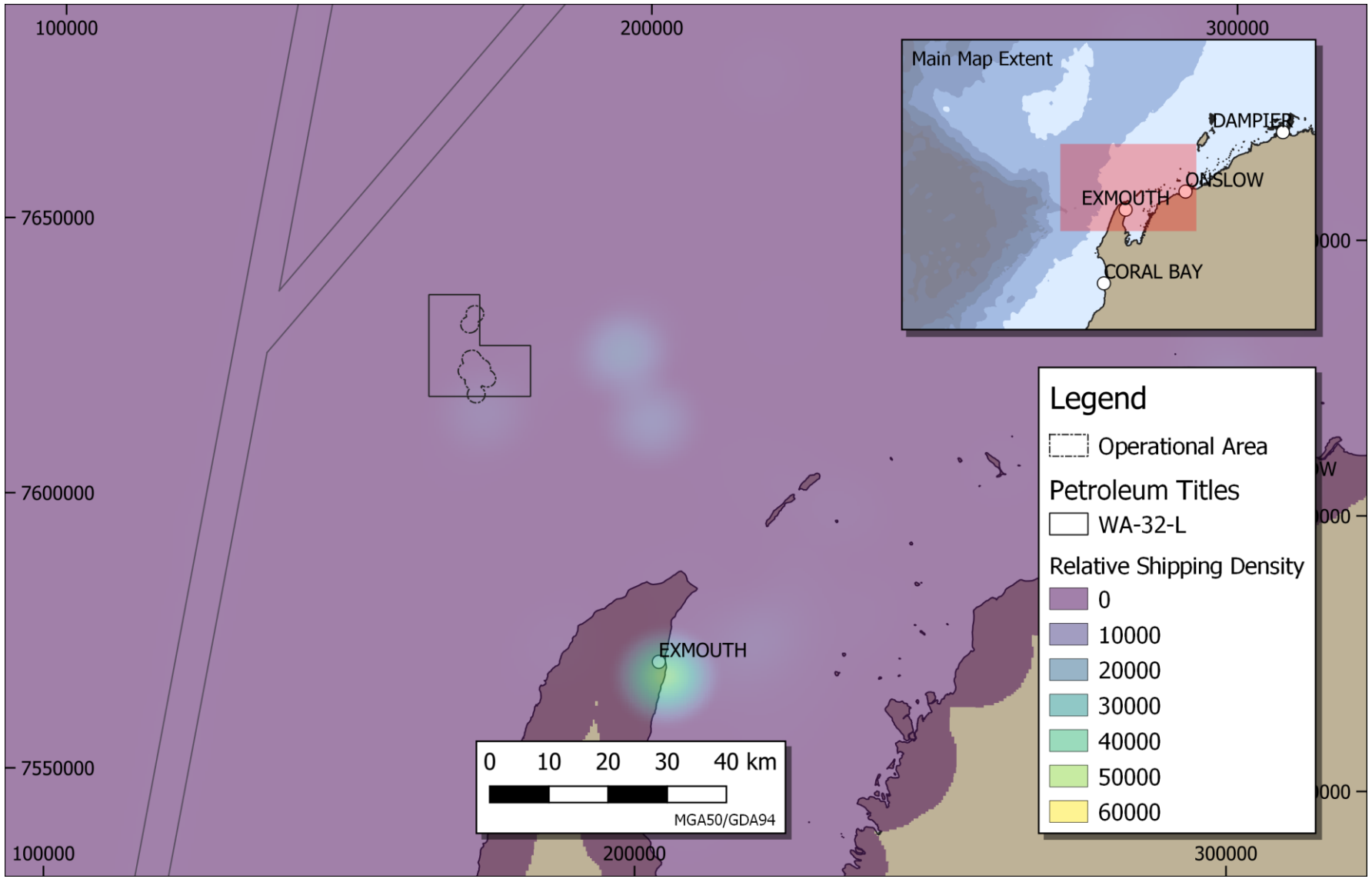

Figure 5-5: Commercial shipping traffic in the vicinity of the operational area

5.6.6 Defence

No defence areas or infrastructure intersects the operational area. The operational area is within the North Western Training Area and military restricted airspace (R8541A) a designated defence exercise area which encompasses waters and airspace off the North West Cape. When activated by a Notice to Airmen (NOTAM), the restricted airspace can operate down to sea level.

6 Stakeholder Engagement

In accordance with requirements of Regulations 11A and 14(9) of the Environment Regulations, Woodside has consulted with relevant and interested stakeholders during the preparation of this EP.

Woodside's approach to stakeholder consultation aims to demonstrate to relevant persons that the environmental impacts and risks of an activity are being appropriately managed. Woodside is committed to ongoing engagement and consultation with stakeholders during all project stages.

Woodside has consulted with relevant stakeholders regarding this petroleum activity, including sharing information with stakeholders and responding directly to enquiries.

Woodside has considered all stakeholder feedback and assessed the merits of responses received. The process adopted to assess any objections and claims is outlined in Section 6.1. A summary of Woodside's responses is provided in Table 6-2.

Woodside considers that consultation with relevant stakeholders has been adequate to inform the development of this EP. Woodside has a process for ongoing stakeholder engagement and any concerns raised by stakeholders after the EP submission will be considered and addressed.

6.1 Stakeholder Engagement Process

6.1.1 Stakeholder Identification

Regulation 11A(1) of the Environment Regulations states that in the course of preparing an environment plan, or revision to an environment plan, the titleholder must consult with each of the following categories of relevant persons:

a) each Department or agency of the Commonwealth to which the activities to be carried out under the environment plan, may be relevant

b) each Department or agency of a State or the Northern Territory to which the activities to be carried out under the environment plan, or the revision of the environment plan, may be relevant

c) the Department of the responsible State Minister, or the responsible Northern Territory Minister

d) a person or organisation whose functions, interests or activities may be affected by the activities to be carried out under the environment plan, or the revision of the environment plan

e) any other person or organisation that the titleholder considers relevant.

Relevant persons for the proposed petroleum activity were identified based on Woodside's existing relationships and relevant persons identified in previous EP consultations, together with desktop stakeholder identification and analysis. Woodside has engaged with key stakeholders through the EP preparation including:

- Commonwealth and State departments and agencies
- Local Government
- Commercial fishery licence holders and their representative associations within both Commonwealth and State managed fisheries that overlap the operational area
- Non-governmental organisations.

As part of Woodside's general stakeholder identification process, the Department of Primary Industries and Regional Development (DPIRD) current State of Fisheries Report and FishCube data was reviewed to understand catch effort, fishing method and water depths of those State-managed fisheries with boundaries that overlap the operational area, to determine if the fishery was to be considered a relevant stakeholder to be consulted.

Commonwealth fisheries were assessed using a similar approach which used the fisheries status reports published by the Australian Bureau of Agricultural and Resource Economics and Sciences to identify fisheries, fishing effort and gear types for fisheries that overlap the operational area. These assessments are included in Table 5-4.

6.1.2 Community Consultation History

Woodside has also consulted wider community interests for this EP, principally through the Exmouth Community Reference Group (CRG), which was established to facilitate consultation in relation to Woodside's assets offshore North West Cape, Western Australia. The CRG forums aim for proactive and regular interaction to promote open and inclusive communication with stakeholders with an interest in Woodside's current and planned activities. Current membership of each CRG includes representatives from local government, Exmouth-based State and Commonwealth Government Departments, local industry, tourism, and community interests.

Meetings are held regularly (typically three times annually) and participants are given an update summary of Woodside's current petroleum and upcoming activities and invited to raise any concerns or issues. Meeting agendas are prepared and circulated in advance of meetings, minutes are recorded, and feedback sought from stakeholders.

The latest Exmouth CRG meeting was held on 7 April 2022 and included an overview of the proposed Stybarrow activities. Exmouth CRG members were also emailed a copy of the Stybarrow End State Decommissioning Environment Plan Stakeholder Information Fact Sheet (Appendix D).

In addition to CRG consultation, targeted consultation has been undertaken for the EP as outlined in Section 6.1.3, with identified stakeholders provided information about the proposed activities and given adequate opportunity to evaluate and convey how it may impact on functions, interests, and activities. The consultation process also provided opportunity for additional stakeholders identified during the consultation process to be contacted, with a commitment to assess any new concerns or claims as part of ongoing consultation.

6.1.3 Identified Stakeholders

Identified stakeholders and an assessment of their relevance under the Environment Regulations for the purposes of consultation for this petroleum activity are listed in Table 6-1.

Table 6-1: Stakeholders engaged with for the proposed activity

Stakeholder	Relevant to Activity	Rationale
Commonwealth Government Department or Agency		
Australian Border Force (ABF)	Yes	Maintain the integrity of Australia's internal borders including customs and immigration.
Australian Fisheries Management Authority (AFMA)	Yes	AFMA is the Commonwealth government agency responsible for the efficient management and sustainable use of Commonwealth fish resources from three nautical miles out to the extent of the Australian Fishing Zone.
Australian Hydrographic Office (AHO)	Yes	The AHO is Commonwealth government agency responsible for the publication and distribution of nautical charts and other information related for the safety of ships navigating in Australian waters including the distribution of Notices to Mariners (NOTMARs).
Australian Maritime Safety Authority (AMSA)	Yes	AMSA is Australia's national agency responsible for maritime safety and navigation and marine pollution response in Commonwealth waters.
Department of Agriculture, Fisheries and Forestry (formerly Department of Agriculture, Water and the Environment) – Fisheries	Yes	Department's Fisheries Branch has primary policy responsibility for promoting the biological, economic and social sustainability of Australian fisheries. DAFF (Fisheries) is the relevant agency where the activity has the potential to negatively impact fishing

Stakeholder	Relevant to Activity	Rationale
		operations and/or fishing habitats in Commonwealth waters.
Department of Agriculture, Fisheries and Forestry (formerly Department of Agriculture, Water and the Environment) – Biosecurity (marine pests)	Yes	Department's Biosecurity Branch has inspection and reporting requirements to ensure that all conveyances (vessels, installations and aircraft) arriving in Australian territory comply with international health regulations and that any biosecurity risk is managed.
Department of Agriculture, Fisheries and Forestry (formerly Department of Agriculture, Water and the Environment) – Biosecurity (vessels, aircraft and personnel)	Yes	Department's Biosecurity Branch has inspection and reporting requirements to ensure that all conveyances (vessels, installations and aircraft) arriving in Australian territory comply with international health regulations and that any biosecurity risk is managed.
Department of Defence (DoD)	Yes	The department is the responsible agency for the defence of Australia and its national interests. DoD is a relevant agency where the proposed activity may impact operational requirements; encroach on known training areas and/or restricted airspace, or when nautical products or other maritime safety information is required to be updated.
Department of Industry, Science, Energy and Resources (DISER)	Yes	The Department is responsible for consolidating the Government's efforts to drive economic growth, productivity, and competitiveness by bringing together industry, energy, resources and science. The Department is required to be consulted under Regulation 11A(1) of the Environment Regulations.
Director of National Parks (DNP)	Yes	The DNP is the statutory authority responsible for the administration and management of the Australian Marine Parks under the EPBC Act.
Western Australian Government Department or Agency		
Department of Biodiversity, Conservation and Attractions (DBCA)	Yes	The Department is a relevant State agency responsible for the management of State marine parks and reserves and protected marine fauna and flora.
Department of Mines, Industry Regulation and Safety (DMIRS)	Yes	Department responsible for the management of offshore petroleum in the adjacent State waters. The Department is required to be consulted under Regulation 11A(1) of the Environment Regulations
DPIRD	Yes	DPIRD is responsible for managed WA State fisheries. The operational area intersects with State managed fisheries.
Department of Transport (DoT)	Yes	The Department is the control agency for marine pollution emergencies in State waters.
Ningaloo Coast World Heritage Advisory Committee (NCWHAC)	Yes	The NCWHAC provides advice to the Australian and Western Australian Governments on the protection, conservation and management of the values of the Ningaloo World Heritage Area.

Stakeholder	Relevant to Activity	Rationale
Fishing Bodies / Industry Representative Organisations		
APPEA	Yes	APPEA is the peak body representing petroleum exploration and production companies.
Australian Southern Bluefin Tuna Industry Association (ASBTIA)	Yes	ASBTIA is the peak body representing the Australian Southern Bluefin Tuna industry.
Commonwealth Fisheries Association (CFA)	Yes	CFA represents the interests of commercial fishing industry in Commonwealth-regulated fisheries, including Skipjack Tuna Fisheries
Marine Tourism Western Australia (MTWA)	Yes	MTWA represents the interests of charter boat operators in Western Australia.
Pearl Producers Association (PPA)	Yes	PPA is the peak industry representative body for the Australian pearl oyster (*Pinctada maxima*) pearling industry licensees in WA.
Recfishwest	Yes	Recfishwest is the peak body representing recreational fishers in WA.
Tuna Australia	Yes	Tuna Australia is the peak body representing the Western Tuna and Billfish Fishery.
Western Australian Fishing Industry Council (WAFIC)	Yes	WAFIC is the peak industry body representing the interests of the WA commercial fishing, pearling and aquaculture sector.
Western Australian Game Fishing Association (WAGFA)	Yes	WAGFA co-ordinates the activities of game fishing throughout Western Australia and has a major role in advocacy on behalf of its member clubs and game fishing in general.
Commonwealth Managed Fisheries		
Western Deep Water Trawl Fishery	Yes[1]	Refer Table 5-4.
Western Tuna and Billfish Fishery	No[2]	Based on a review of ABARES current fisheries status reports, the fishery boundaries overlap the proposed operational area and the fisheries have not been active in the region in recent years (refer Table 5-4). Licence holders have not been consulted during the development of the EP; however, fishery's interest considered in the development of the EP. CFA to be informed in the event of an unplanned emergency oil pollution event.
Sothern Bluefin Tuna Fishery	No[2]	
Skipjack Tuna Fishery	No[2]	
State Managed Fisheries		
Mackerel Managed Fishery (Area 3)	Yes[1]	Based on a review of DPIRD current State of Fisheries Report and FishCube data, the fisheries boundaries overlap the operational area and the fishery has been active in recent years (refer Table 5-4).
West Coast Deep Sea Crustacean Managed Fishery	Yes[1]	
Marine Aquarium Fishery	No[2]	Based on a review of DPIRD current State of Fisheries Report and FishCube data, the fishery boundaries overlap the proposed operational area
Pearl Oyster Managed Fishery	No[2]	

Stakeholder	Relevant to Activity	Rationale
Pilbara Crab Managed Fishery	No[2]	and the fisheries have not been active in recent years (refer Table 5-4). Licence holders have not been consulted during the development of the EP; however, fishery's interest considered in the development of the EP. DPIRD to be informed in the event of an unplanned emergency oil pollution event.
Pilbara Line Fishery	No[2]	
South West Coast Salmon	No[2]	
Other Stakeholders		
Local Government • Shire of Exmouth	Yes	Represents the interests of local community members relevant to the progressive decommissioning of the Stybarrow facilities.
CRGs • Exmouth CRG	Yes	Representatives from local government, locally based State and Commonwealth Government Departments, local industry, tourism, and organisations with Indigenous, conservation and community interests.
Indigenous • Yamatji Marlpa Aboriginal Corporation (YMAC) on behalf of the Nganhurra Thanardi Garrbu Aboriginal Corporation	Yes	Represents the interests of native title claimants in the regions relevant to the progressive decommissioning of the Stybarrow facilities.
Industry • Exmouth Chamber of Commerce and Industry	Yes	Represents the interests of businesses in the regions relevant to the progressive decommissioning of the Stybarrow facilities.
Fishing clubs • Exmouth Game Fishing Club	Yes	Represents the interests of recreational fishing club members in the regions relevant to the progressive decommissioning of the Stybarrow facilities.
Charter Boat / Marine Tourism Operators • Exmouth-based	Yes	May undertake marine tourism activities in proximity of the planned activities.
Cape Conservation Group (CCG)	Yes	Exmouth-based community and volunteer conservation group with an interest in conservation of the North West Cape.
Australian Marine Oil Spill Centre (AMOSC)	Yes	Industry-funded organisation to coordinate and support marine pollution response.

[1] Commercial fisheries with boundaries overlapping or close to the planned petroleum operational area and with licence holders' activities or interests that may be affected by the planned petroleum activity.

[2] Commercial fisheries with boundaries overlapping or close to the planned petroleum operational area, but licence holders' activities or interests are not expected to be affected by the planned petroleum activity.

6.1.4 Stakeholder Consultation Activities

Woodside's consultation for this EP included the wide distribution of a general Fact Sheet (Appendix D) and follow up email correspondence. The information provided included the timing and duration of the activity, the mitigation measures for relevant impacts and risks, Woodside's policies and experience, and contact details to facilitate providing feedback to Woodside.

Recent stakeholder engagement and consultation activities informing this EP include:

- Stybarrow End State Decommissioning Environment Plan Stakeholder Information Fact Sheet (Appendix D) distributed to relevant stakeholders
- Exmouth CRG meeting held on 7 April 2022

All stakeholder engagement records are maintained by Woodside Corporate Affairs.

6.1.5 Assessment of Stakeholder Objections and Claims

A summary of the stakeholder consultation undertaken for this EP, including responses received, Woodside's assessment of all comments received and how each of the responses has been addressed in the EP is provided in Table 6-2. Full transcripts between Woodside and stakeholders are provided in a confidential submission to NOPSEMA.

No objections or significant concerns were raised by stakeholders during consultation in the preparation of this EP.

Table 6-2: Stakeholder consultation summary

Organisation	Summary of Stakeholder and Titleholder Correspondence and any Objections and Claims Made	Assessment of Stakeholder Objections and Claims
Commonwealth Government Department or Agency		
ABF	ABF was provided the Stybarrow P&A and Decommissioning Environment Plans Fact Sheet (Appendix D) by email on 27 May 2022.	No response has been received from ABF at the time of submission of the EP. Woodside will address any comments from this stakeholder should they arise in the future.
AFMA	AFMA was provided the Stybarrow P&A and Decommissioning Environment Plans Fact Sheet (Appendix D) by email on 27 May 2022. AFMA responded by email on 1 June 2022 and provided the following response: 1. AFMA did not have any specific comment on proposed activities. 2. AFMA noted it was important to consult with all operators who have entitlements to fish within the proposed area, which could be done through the relevant fishing industry associations or directly with operators who hold entitlements in the area. 3. AFMA provided details on representative organisations and how to obtain contact details for licence holders. Woodside responded by email on 27 July and provided the following response: 1. Woodside noted AFMA did not have any specific comment on proposed activities. 2. Woodside re-confirmed it had consulted licence holders in the Western Deepwater Trawl Fishery 3. Woodside has consulted representative organisations and licence holders as per AFMA contact details.	Woodside notes AFMA's response and considers it has addressed the stakeholder's feedback and no further consultation is required.
AHO	AHO was provided the Stybarrow P&A and Decommissioning Environment Plans Fact Sheet (Appendix D) by email on 27 May 2022.	No response has been received from AHO at the time of submission of the EP. No action required, noting feedback provided by AMSA on 1 June 2022 requesting Woodside to notify the AHO no less than four weeks before operations, with details relevant to the operations for the AHO promulgate the appropriate NOTMAR. Section 8.1 relates to the physical presence of vessels and infrastructure. Section 8.1 includes reporting and notification requirements including those to AHO. Woodside considers it has addressed the stakeholder's feedback and no further consultation is required.
AMSA – maritime safety	AMSA was provided the Stybarrow P&A and Decommissioning Environment Plans Fact Sheet (Appendix D) by email on 27 May 2022. AMSA responded on 1 June 2022 providing the following requests: • The AHO must be contacted through datacentre@hydro.gov.au no less than four working weeks before operations commence for the promulgation of related notices to mariners. • Please have the main vessel/s notify AMSA's Joint Rescue Coordination Centre (JRCC) for promulgation of radio-navigation warnings 24-48 hours before operations commence. AMSA's JRCC will require the vessel details (including name, call sign and Maritime Mobile Service Identity), satellite communications details (including INMARSAT-C and satellite telephone), area of operation, requested clearance from other vessels and need to be advised when operations start and end. • You should plan to provide updates to both the AHO and the JRCC on progress and, importantly, any changes to the intended operations. AMSA also reminded Woodside of its obligations to comply with the International Rules for Preventing Collisions at Sea (COLREGS), in particular, the use of appropriate lights and shapes to reflect the nature of operations (e.g., restricted in the ability to manoeuvre). Vessels should also ensure their navigation status is set correctly in the ship's AIS unit.	Woodside notes AMSA's feedback on Maritime Safety Information and will: • Notify the AHO no less than four weeks before operations, with details relevant to the operations in order for the AHO promulgate the appropriate NOTMAR. • Notify AMSA's JRCC at least 24-48 hours before operations commence, in order to promulgate radio-navigation warnings. • Notify AHO and the JRCC in the event of changes to intended operations. Section 8.1 relates to the physical presence of vessels and infrastructure. Figure 5-5 includes vessel traffic plotting. Section 8.1 includes reporting and notification requirements including those to AHO and AMSA. Woodside considers it has addressed the stakeholder's feedback and no further consultation is required.

Organisation	Summary of Stakeholder and Titleholder Correspondence and any Objections and Claims Made	Assessment of Stakeholder Objections and Claims
	AMSA provided contact details for Woodside obtain a vessel traffic plot showing Automatic Identification System (AIS) traffic data. Woodside responded by email on 28 July 2022 advising it would: 1. Notify the AHO no less than four weeks before operations, with details relevant to the operations in order for the AHO to promulgate the appropriate Notice to Mariners. 2. Notify AMSA's Joint Rescue Coordination Centre (JRCC) at least 24-48 hours before operations commence, in order to promulgate radio-navigation warnings. 3. Notify AHO and the JRCC in the event of changes to intended operations. Woodside notes AMSA's feedback the exhibition of appropriate lights and shapes and will: • Comply with the International Rules for Preventing Collisions at Sea • Ensure vessel navigation status is set correctly in the ship's AIS unit.	
AMSA – marine pollution	AMSA was provided the Stybarrow P&A and Decommissioning Environment Plans Stakeholder Information Fact Sheet (Appendix D) by email on 27 May 2022.	No response has been received from AMSA at the time of submission of the EP. Woodside will address any comments from this stakeholder should they arise in the future.
Department of Agriculture, Fisheries and Forestry (formerly Department of Agriculture, Water and the Environment) – Biosecurity	DAFF was provided the Stybarrow P&A and Decommissioning Environment Plans Fact Sheet (Appendix D) by email on 27 May 2022.	No response has been received by DAFF at the time of submission of the EP. No further consultation is required.
Department of Agriculture, Fisheries and Forestry (formerly Department of Agriculture, Water and the Environment) – Fisheries	DAFF was provided the Stybarrow P&A and Decommissioning Environment Plans Fact Sheet by email on 11 March 2022.	No response has been received by DAFF at the time of submission of the EP. Woodside has addressed matters relevant to DAFF's interests in the following section of the EP: • Section 8.1 relates to the physical presence of vessels and infrastructure and includes impacts to fisheries No further consultation is required.
Department of Climate Change, Energy, the Environment and Water, (DCCEEW) (formerly Department of Agriculture, Water and the Environment) – Sea Dumping	Discussions have been held in person and over WEBEX with the Sea Dumping Division of DCCEEW, confirming that Sea Dumping permits will be required for the equipment proposed to be left *in situ*.	Woodside will continue to consult with DCCEEW as the Sea Dumping Permitting is progressed.
DoD	DoD was provided the Stybarrow P&A and Decommissioning Environment Plans Fact Sheet (Appendix D) by email on 27 May 2022.	No response has been received from DoD at the time of submission of the EP. No further consultation is required.
DNP	DNP was provided the Stybarrow P&A and Decommissioning Environment Plans Fact Sheet (Appendix D) by email on 27 May 2022. DNP responded by email on 26 July 2022 and requested further information in relation to: 1. The removal of the H4 flowline and the potential release of 14 m^3 (approximately 88 barrels) into the marine environment. Information is to contain dispersal modelling, chemical makeup of the hydrocarbons, risk to marine park natural values (note species below) and mitigations. 2. The assessment undertaken to guide decisions to remove or leave equipment *in situ* and can include, but not limited, environmental risks / benefits analysis. DNP also made the following comments/requests: 1. Proposed activities may directly affect the values present in the marine parks and should be factored into the environment plan.	Woodside acknowledges DNP's feedback. Removal of the H4 flowline is not applicable to the Stybarrow End State Decommissioning EP (this EP). Impacts and risks associated with removal of the H4 flowline is included in Stybarrow Decommissioning and Field Management EP (BHPB-00SC-N000-003). Decommissioning alternatives EIA is provided in Section 3. BIAs have been presented in Section 5.5.2. KEFs have been presented in Section 5.4.1. Australian Marine Parks have been presented in Section 5.4.5. The environmental impacts and risks from the petroleum activities in this EP will not credibly impact upon a marine park, hence no mechanism to notify the DNP has been provided in the EP. Woodside considers it has addressed DNP's feedback at this time, but will continue to liaise with the Department should they have any further queries.

Organisation	Summary of Stakeholder and Titleholder Correspondence and any Objections and Claims Made	Assessment of Stakeholder Objections and Claims
	2. Proposed activities should be undertaken with the utmost care and an absolute avoidance of unplanned impacts upon the environment now and into the future given the proximity of the operational area is nearby to the Ningaloo Coast World Heritage Area. 3. The environment plan should demonstrate best practice in choice of activities, such as leaving equipment in situ, and mitigating the activity's impact upon the environment. 4. DNP provided feedback on biologically important areas (BIAs) that are present or nearby to the operational area. 5. DNP provided feedback on Key Ecological Features (KEF) that are present or nearby to the operational area, which are identified values of the Gascoyne and Ningaloo Marine Parks and activities that could affect these features should be factored into risk assessments. 6. DNP noted that there may also be cultural values present provided advice on consultation with Indigenous peoples and representative organisations where sea country could be affected by the proposed activities. **Guidance information** DNP provided guidance on resource materials to assist in the development of the EP with respect to assessing Australian marine parks and their representativeness, including: • The North-west Marine Parks Network Management Plan 2018 (management plan) • The Australian Marine Parks Science Atlas **Emergency response** DNP provided details on its expectations for the Marine Compliance Duty Officer to be advised within 24 hours in the event that a marine pollution event is likely to impact on a marine park. DNP also advised that it may request daily or weekly Situation Reports, depending on the scale and severity of the pollution incident. Woodside responded to DNP by email on 28 July 2022 and provided the following feedback: 1. The H4 flowline was blocked during production following a sand screen failure in 2010. The contents of the flowline are production fluids (oil, gas formation water), sand and hydrates. The flowline is proposed to be unblocked and fully recovered. Methods to achieve this are in development with industry specialists. BHP committed to providing the DNP with an assessment potential marine impacts and mitigation measures when the Oil Pollution Emergency Plan (OPEP) is complete. 2. Woodside provided a summary of the decommissioning assessment options and criteria, and high-level outcomes. Woodside also provided the following feedback: 1. Woodside stated that potential impacts to marine park values had been assessed in developing the Environment Plan. 2. Woodside acknowledged the environmental sensitivity of the region and the need for utmost care in undertaking planned activities. 3. The EP includes an assessment of planned activities, including leaving equipment in situ, and mitigating the activity's impact upon the environment. 4. Woodside confirmed that BIAs had been assessed in the EP. 5. Woodside confirmed that KEFs had been assessed in the EP. 6. Woodside confirmed it had provided information to the Yamatji Marlpa Aboriginal Corporation on behalf of the Nganhurra Thanardi Garrbu Aboriginal Corporation as part of consultation activities. **Guidance information** Woodside acknowledged references provided by DNP to support development of the EP, these being:	

Organisation	Summary of Stakeholder and Titleholder Correspondence and any Objections and Claims Made	Assessment of Stakeholder Objections and Claims
	• The North-west Marine Parks Network Management Plan 2018 (management plan) • The Australian Marine Parks Science Atlas **Emergency response** Woodside confirmed that DNP's expectations and contact details for consultation in the event of incident that was likely to impact a marine park that had been included in the EP. DNP responded by email on 28 July 2022 and provided the following feedback: 1. DNP noted the matters raised by the Director of National Parks will be captured in the environment plan and that Woodside will provide an update the in regards to the OPEP when it is available. 2. DNP requested the draft environment plan or parts that relate to the assessment of decommissioning options when available. Woodside responded by email on 29 July 2022 and provided the following feedback: 1. Woodside thanked DNP for its response. 2. Woodside advised that it was not able to provide more fulsome details of the options assessment in advance of the EP being finalised and suggested that DNP is provided relevant references when the EP is finalised and has been submitted to NOPSEMA. This would allow DNP access to all relevant information in order to provide informed feedback. BHP committed to ongoing consultation with DNP through EP assessment, with a summary of all comments included in the final EP for assessment and acceptance by NOPSEMA. DNP responded by email on 29 July 2022 acknowledging Woodside's response and requesting the Department be advised when the Environment Plan has been published on NOPSEMA's website. The Department will make contact if it has any additional questions or feedback. Note: Stakeholder comments related to the OPEP are only relevant to the Stybarrow P&A EP; no credible hydrocarbon spill scenarios associated with the Stybarrow End State Decommissioning EP (this EP).	
DISER	DISER was provided the Stybarrow P&A and Decommissioning Environment Plans Fact Sheet (Appendix D) by email on 27 May 2022.	No response has been received at the time of submission of the EP. Woodside will address any comments from this stakeholder should they arise in the future
Western Australian Government Department		
DBCA	DBCA was provided the Stybarrow P&A and Decommissioning Environment Plans Fact Sheet (Appendix D) by email on 27 May 2022. DBCA responded on 2 June 2022 and advised it had no comments on proposed activities in relation to its responsibilities under the *Conservation and Land Management Act 1984* and *Biodiversity Conservation Act 2016*. Woodside emailed DBCA on 27 July acknowledging its advice.	Woodside considers it has addressed the stakeholder's feedback and no further consultation is required.
DMIRS	DMIRS was provided the Stybarrow P&A and Decommissioning Environment Plans Fact Sheet (Appendix D) by email on 27 May 2022. DMIRS responded by email on 22 June 2022 and provided the following feedback: – DMIRS noted that proposed activities would be assessed under assessed under the Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2009 and regulated by the National Offshore Petroleum Safety and Environmental Management Authority (NOPSEMA). – DMIRS did not require further information at this stage. – DMIRS requested pre-start and cessation of activity notifications.	Woodside notes DMIRS request for pre-start and cessation of activity notifications. Section 8.1 includes reporting and notification requirements including those to DMIRS. None of the environmental impacts and risks considered in this EP will credibly impact upon land or water in State jurisdiction.

Organisation	Summary of Stakeholder and Titleholder Correspondence and any Objections and Claims Made	Assessment of Stakeholder Objections and Claims
	– DMIRS provided advice on consultation in the event that an incident could potentially impact on any land or water under State jurisdiction. – Woodside responded on 27 July 2022 with the following response: – Woodside noted DMIRS acknowledgement that the EP would be assessed by NOPSEMA – Woodside noted DMIRS required no further information – Woodside confirmed it would notify DMIRS prior to and following the cessation of activities – Woodside confirmed the EP would include information about the reporting of environmental incidents that could potentially impact on any land or water in State jurisdiction, including requested contact details for DMIRS. – Woodside notes that feedback on State waters EPs are outside the scope of this EP.	
DPIRD	DPIRD was provided the Stybarrow P&A and Decommissioning Environment Plans Fact Sheet (Appendix D) by email on 27 May 2022.	No response has been received by DPIRD at the time of submission of the EP. No further consultation is required.
DoT	DoT was provided the Stybarrow P&A and Decommissioning Environment Plans Fact Sheet (Appendix D) by email on 27 May 2022. DoT responded by email on 7 June 2022 and provided advice on consultation if there was a risk that a spill could impact State waters from proposed activities. Woodside responded by email on 28 July 2022 confirming that it acknowledged DoT's consultation requirements (Appendix 6 of the Department of Transport Offshore Petroleum Industry Guidance Note – Marine Oil Pollution: Response and Consultation Arrangements, July 2020) and would provide a copy of the OPEP for consultation. Note: Stakeholder comments related to the OPEP are only relevant to the Stybarrow P&A EP; no credible hydrocarbon spill scenarios associated with the Stybarrow End State Decommissioning EP (this EP).	The petroleum activities OPEP will be provided to DoT for consultation in relation to the Stybarrow P&A EP.
NCWHAC	NCWHAC was provided the Stybarrow P&A and Decommissioning Environment Plans Fact Sheet (Appendix D) by email on 27 May 2022.	No response has been received at the time of submission of the EP. Woodside will address any comments from this stakeholder should they arise in the future.
Fishing Bodies / Industry Representative Organisations		
APPEA	APPEA was provided the Stybarrow P&A and Decommissioning Environment Plans Fact Sheet (Appendix D) by email on 27 May 2022.	No response has been received at the time of submission of the EP. Woodside will address any comments from this stakeholder should they arise in the future.
ASBTIA	ASBTIA was provided the Stybarrow P&A and Decommissioning Environment Plans Fact Sheet (Appendix D) by email on 27 May 2022.	No response has been received from ASBTIA at the time of submission of the EP. Section 8.1 relates to the physical presence of infrastructure and includes impacts to fisheries. Woodside will address any comments from this stakeholder should they arise in the future.
CFA	CFA was provided the Stybarrow P&A and Decommissioning Environment Plans Fact Sheet (Appendix D) by email on 27 May 2022.	No response has been received from CFA at the time of submission of the EP. Section 8.1 relates to the physical presence of infrastructure and includes impacts to fisheries. Woodside will address any comments from this stakeholder should they arise in the future.
MTWA	MTWA was provided the Stybarrow P&A and Decommissioning Environment Plans Fact Sheet (Appendix D) by email on 27 May 2022.	No response has been received from Marine Tourism WA at the time of submission of the EP. Woodside will address any comments from this stakeholder should they arise in the future.
PPA	PPA was provided the Stybarrow P&A and Decommissioning Environment Plans Fact Sheet (Appendix D) by email on 27 May 2022.	No response has been received from PPA at the time of submission of the EP. Woodside will address any comments from this stakeholder should they arise in the future.

Organisation	Summary of Stakeholder and Titleholder Correspondence and any Objections and Claims Made	Assessment of Stakeholder Objections and Claims
Recfishwest	Recfishwest was provided the Stybarrow P&A and Decommissioning Environment Plans Fact Sheet (Appendix D) by email on 27 May 2022. Recfishwest responded on 17 June 2022 and providing the following feedback: • Recfishwest is the peak body representing the interests of the estimated 740,000 recreational fishers in Western Australia. Recfishwest are a not-for-profit community-based organisation that endeavours to ensure high quality recreational fishing experiences are maintained and enjoyed for all in the community. • Recreational fishing is an integral part of the Pilbara lifestyle. The region's unique coastline includes some of Australia's prime fishing locations and includes an array of offshore islands, coral reef systems and offshore habitats, providing ample recreational fishing opportunities which hold a plethora of high valued species making it a key driver of visitation to the region, attracting visitors from around the state and country. • Recfishwest places the highest priority on preserving the marine environment and safeguarding the future of our recreational fishing experiences, which are reliant on healthy habitats and abundant fish stocks. While the planned activities stated in these environmental plans are located a fair distance from shore, the field is still actively fished by members of the recreational fishing community. • We also take note of the previous correspondence from Woodside which advises recreational fishers to observe a 500m safety exclusion zone around the wells and a 1500m radius around the operational area for the duration of the activity. • It is also promising to see that some structures will be left in situ, as the assessment concluded that leaving these items in the water was a better outcome for the environment, as it will avoid the damage caused by their removal and these structures not containing any plastics or known marine contaminants. • In review of the work planned in the environmental plans for stakeholder consultation, Recfishwest do not object with the steps taken by Woodside to address concerns that the recreational fishing sector might have. • Additionally, Recfishwest would like to kindly request to be consulted on any upcoming offshore exploration activities, irrespective of the distance from shore and that all charts are updated, so recreational fishers can locate the areas. Woodside responded by email on 28 July 2022 and provided the following feedback: 1. Woodside acknowledged Recfishwest's advocacy role on behalf of recreational fishers in Western Australia. 2. Woodside acknowledged the social importance to regional communities of recreational fishing. 3. Woodside acknowledged the potential presence of recreational fishers at the activity location. 4. Woodside notes feedback from Recfishwest on exclusion zones. 5. Woodside notes feedback on BHP's assessment for leaving some structures in situ. 6. Woodside notes that Recfishwest does not object to planned activities. 7. Woodside advised it will continue to keep Recfishwest informed of planned activities and that nautical charts are maintained.	Woodside considers it has addressed the stakeholder's feedback and no further consultation is required
Tuna Australia	Tuna Australia was provided the Stybarrow P&A and Decommissioning Environment Plans Fact Sheet (Appendix D) by email on 27 May 2022. Tuna Australia responded by email on 17 June 2022 and provided the following feedback: 1. Tuna Australia is putting together a consultation submission on the Stybarrow decommissioning environmental plans.	Woodside considers it has addressed Tuna Australia's feedback and no further consultation is required.

Organisation	Summary of Stakeholder and Titleholder Correspondence and any Objections and Claims Made	Assessment of Stakeholder Objections and Claims
	2. Tuna Australia sought additional time beyond the consultation closing date to provide feedback on proposed activities as it was still waiting on feedback from members holding Statutory Fishing Rights in the Western Tuna Billfish Fishery (WTBF). Tuna Australia responded by email on 1 July 2022 and provided the following feedback: 1. Tuna Australia provided background information on the fishery, including target species and historical locations for fishing activity. 2. Tuna Australia noted that there had been no recent fishing effort at the Stybarrow location. 3. Tuna Australia advised that several of its members were pursuing joint venture fishing arrangements with the Australian government to work these fishing grounds. 4. Tuna Australia advised it was assisting a fisher to access WTBF licences and quota to commence fishing activities from Exmouth from the start of the 2023 season, with potential for spatial conflict arising from Woodside's planned activities. 5. Tuna Australia drew Woodside's attention to the importance of the Leeuwin current as an important fauna distribution feature, including the target species of the WTBF. Tuna Australia made the following claims/requests: 6. It is not evident from the risk management plan that these impacts have been considered or mitigated to an extent that would not impact tuna quality. We would like to see more specific mitigation detail regarding this in the relevant risk assessments. 7. A nuance of longline fishing is that the gear is set to drift with the currents and weather influences. Fishers have very little control over the distance and direction of the drift until they haul the gear. The risk management plans speak in general terms about cautionary areas, exclusion zones and notices to mariners. We would like to understand how Woodside contracted vessels in these areas can deconflict themselves from drifting longline gear should it enter the Operational area 8. The risk assessments are silent on potential impacts on the electrical and acoustic interferences that may be generated by machinery or vessels used in these activities. This may impact on fishing vessel instrumentation, navigation systems and fish detecting equipment. Is there likely to be any undue acoustic or frequency disturbances produced by these proposed activities? 9. For the activities identified in these proposals, we would like to be reassured that these are done in the most expeditious timeframe and with utmost regard to the marine environment to maintain the integrity of the marine resource and impacts on other lawful users. Woodside responded by email on 29 July 2022 and provided the following feedback: 1-5. Woodside acknowledged the feedback provided by Tuna Australia on behalf of its members on current and potential future fishing activities. 6. Woodside provided additional information on expected marine discharges and seabed disturbances, as well as expected impacts resulting from items proposed to be left in situ. 7. Woodside provided additional information on the administration of and access to the safety exclusion zones and precautionary areas, as well as opportunities to establish on-water communications protocols to ensure the safety of all marine users. 8. Woodside advised that acoustic impacts will be limited to vessel noise and noises associated with cutting activities at the seabed. 9. Woodside confirmed it planned to undertake proposed activities in accordance with the Environment Plan and as expeditiously as possible.	

Organisation	Summary of Stakeholder and Titleholder Correspondence and any Objections and Claims Made	Assessment of Stakeholder Objections and Claims
	BHP also provided further detail on activities and the completion date associated with the progressive decommissioning of the Stybarrow Field.	
WAFIC	WAFIC was provided the Stybarrow P&A and Decommissioning Environment Plans Fact Sheet (Appendix D) by email on 27 May 2022. WAFIC responded by email on 4 July 2022 and provided the following feedback: 1. WAFIC supports the P&A of 10 production/injection wells and the removal of the H4 flexible production flowline. 2. Can you please confirm what material is contained in the suction gravity bases for the riser holdbacks and water injection manifold? 3. What does it mean to have riser bases 4 m in diameter and 7 m high left *in situ*? Can you please provide detail of Woodside's assessment? Woodside responded by email on 28 July 2022 and provided the following feedback: 1. Woodside acknowledges WAFIC's feedback on the P&A of 10 production/injection wells and the removal of the H4 flexible production flowline 2. Woodside provided details on the composition of the suction gravity bases. 3. Woodside confirmed that recent ROV footage showed that approximately 0.75m of the suction gravity bases was protruding from the seabed. 4. Woodside provided a summary of the decommissioning assessment options and criteria, and high-level outcomes Woodside also advised that since consultation material was provided to stakeholders, a historical exploration wellhead (Eskdale-1) within the field has been identified and added to the leave *in situ* scope. Woodside provided details on the dimensions and composition of the wellhead, including previous unsuccessful efforts to remove the wellhead in 2003 when the well was plugged and abandoned.	Woodside has responded to WAFIC's request for information and considers it has addressed the stakeholder's feedback and no further consultation is required. Section 8.1 relates to the physical presence of infrastructure and includes impacts to fisheries. Removal of the H4 flowline is not applicable to the Stybarrow End State Decommissioning EP (this EP). Impacts and risks associated with removal of the H4 flowline is included in Stybarrow Decommissioning and Field Management EP (BHPB-00SC-N000-003).
Commonwealth Managed Fisheries		
Western Deepwater Trawl Fishery	Licence holders were provided the Stybarrow P&A and Decommissioning Environment Plans Fact Sheet (Appendix D) by email on 27 May 2022.	No response has been received from Commonwealth managed fishery licence holders at the time of submission of the EP. Section 8.1 relates to the physical presence of infrastructure and includes impacts to fisheries. Woodside will address any comments from this stakeholder should they arise in the future.
State Managed Fisheries		
• Mackerel Managed Fishery (Area 3) • West Coast Deep Sea Crustacean Managed Fishery	Licence holders were provided the Stybarrow P&A and Decommissioning Environment Plans Fact Sheet (Appendix D) by email on 27 May 2022	No response has been received from State managed fishery licence holders at the time of submission of the EP. Section 8.1 relates to the physical presence of vessels and infrastructure and includes impacts to fisheries. Woodside will address any comments from this stakeholder should they arise in the future.
Other Stakeholders		
Local Government • Shire of Exmouth (SoE)	SoE was provided the Stybarrow P&A and Decommissioning Environment Plans Fact Sheet (Appendix D) by email on 27 May 2022.	No response has been received from SoE at the time of submission of the EP. Woodside will address any comments from this stakeholder should they arise in the future.
CRGs • Exmouth CRGs	Exmouth CRG was provided the Stybarrow P&A and Decommissioning Environment Plans Fact Sheet (Appendix D) by email on 27 May 2022.	No response has been received from the CRG at the time of submission of the EP. Woodside will address any comments from this stakeholder should they arise in the future.

Organisation	Summary of Stakeholder and Titleholder Correspondence and any Objections and Claims Made	Assessment of Stakeholder Objections and Claims
Indigenous • YMAC on behalf of the Nganhurra Thanardi Garrbu Aboriginal Corporation	YMAC was provided the Stybarrow P&A and Decommissioning Environment Plans Fact Sheet (Appendix D) by email on 27 May 2022.	No response has been received from YMAC at the time of submission of the EP. Woodside will address any comments from this stakeholder should they arise in the future.
Industry • Exmouth Chamber of Commerce and Industry (ECCI)	ECCI was provided the Stybarrow P&A and Decommissioning Environment Plans Fact Sheet (Appendix D) by email on 27 May 2022..	No response has been received from the ECCI at the time of submission of the EP. Woodside will address any comments from this stakeholder should they arise in the future
Fishing clubs • Exmouth Game Fishing Club	Exmouth Game Fishing Club was provided the Stybarrow P&A and Decommissioning Environment Plans Fact Sheet (Appendix D) by email on 27 May 2022. EGFC responded by email on 31 May 2022 and provided the following request: 1. EGFC requested that decommissioning activities around the Stybarrow field be halted or not commence until after our GAMEX tournament which takes place in March each year due to the potential for a high numbers of small boats fishing during our GAMEX event. BHP responded to EGCF on 28 July 2022 and provided the following response: Woodside responded to EGCF on 28 July 2022 and provided the following response: 1. Woodside acknowledged feedback from the EGFC and advised that at this time it was not planning to be in the field in March 2023. Woodside recommended maintaining contact as planning progressed for mutual activities. Woodside also provided details on access to the Stybarrow location during planned activities.	Woodside considers it has addressed EGCF's feedback and no further consultation is required at this time.
Charter Boat / Marine Tourism Operators • Exmouth	Exmouth-based charter boat / marine tourism operators were provided the Stybarrow P&A and Decommissioning Environment Plans Fact Sheet (Appendix D) by email on 27 May 2022.	No response has been received from Exmouth-based charter operators at the time of submission of the EP. Woodside will address any comments from this stakeholder should they arise in the future.
CCG	The CCG was provided the Stybarrow P&A and Decommissioning Environment Plans Fact Sheet (Appendix D) by email on 27 May 2022.	No response has been received from CCG at the time of submission of the EP. Woodside will address any comments from this stakeholder should they arise in the future.
AMOSC	AMOSC was provided the Stybarrow P&A and Decommissioning Environment Plans Fact Sheet (Appendix D) by email on 27 May 2022.	No response has been received from AMOSC at the time of submission of the EP. Woodside will address any comments from this stakeholder should they arise in the future.

6.2 Ongoing Consultation

Stakeholder consultation will be ongoing and Woodside will work with stakeholders to address any future concerns if they arise prior to the end of this EP. Should any new stakeholders be identified, they will be added to the stakeholder database and included in all future correspondence as required.

Woodside's commitments to ongoing consultation include:

- Continued quarterly Exmouth CRG meetings.
- Responding in a timely manner to all stakeholder and community contact regarding the proposed Stybarrow decommissioning activities.
- Stakeholders who raise objections and claims following EP submission will be responded to directly, and should any concerns raised have not already been addressed in the EP, these will be assessed in the same manner as all risks identified by Woodside.

7 Woodside Environmental Risk Management Framework

Woodside has established a risk management governance framework with supporting processes and performance requirements that provide an overarching and consistent approach for identifying, assessing and managing risks. Woodside Policies have been formulated to comply with the intent of the Risk Management Policy and are consistent with the AS/ISO 31000-2009 Risk Management Principles and Guidance.

An integrated risk assessment and impact process is used to identify the most appropriate management strategy and relevant controls to reduce impacts and risks from planned (routine and non-routine) activities and unplanned (accidents/incidents) events to as low as reasonably practicable (ALARP) and acceptable levels (Figure 7-1). The process includes incorporating historic stakeholder and legal and environmental monitoring data for the relevant environmental impacts.

7.1 Evaluation of Impacts and Risks

The primary objective of the impact and risk assessment is to demonstrate that the identified impacts and risks associated with the petroleum activity (Section 3) are reduced to ALARP and are of an acceptable level to Woodside. An environment hazard identification (ENVID) workshop was conducted in February 2022 to support the impact and risk assessment and involved participants from the Woodside HSE, projects and engineering departments and specialist environmental consultants.

The impact and risk assessment process is illustrated in Figure 7-1 and considers planned (routine and non-routine) activities, unplanned (accidents/incidents) events and emergency conditions. The process includes:

- confirming the sources of hazards for the planned activities and unplanned events
- identifying environmental impact and risk receptors
- analysing environmental impact and risk receptors
- identifying potential controls to reduce the impacts and risks
- allocating a likelihood rating for all unplanned events
- allocating a severity rating for all planned activities and unplanned events
- accepting controls through an ALARP process
- assessing final acceptability of the risks and impacts using the Woodside acceptability criteria.

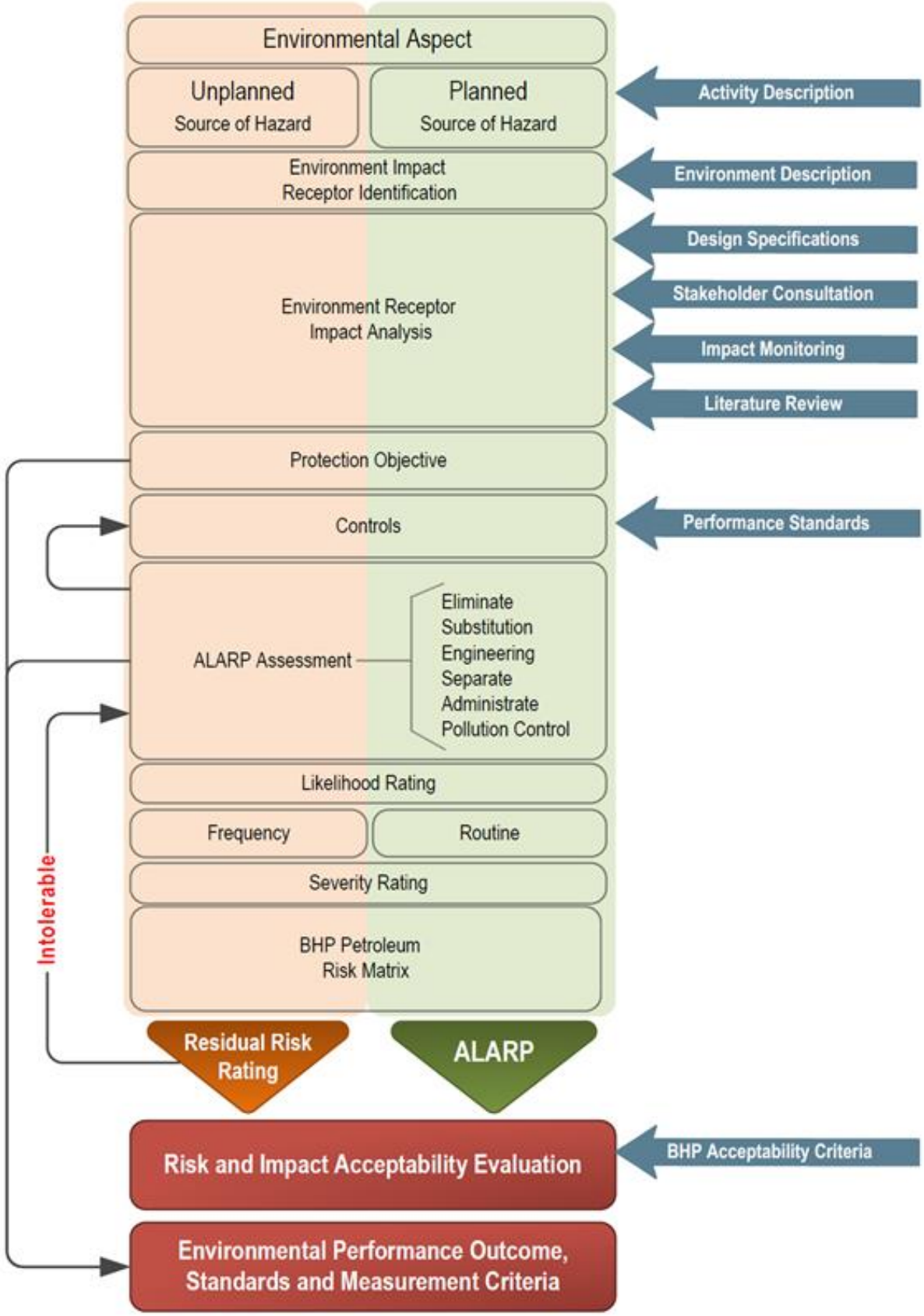

Figure 7-1: Environment Plan Integrated Impact and Risk Assessment Process

7.1.1 Decision Context

Consistent with the United Kingdom Offshore Operators Association Framework for Risk-Related Decision Support (Oil and Gas UK, 2014), Woodside has applied decision criteria to determine whether impacts and risks created during the petroleum activity constitute 'lower-order' or 'higher-order' impacts and risks, and subsequently how each are managed to ALARP (Section 7.2) and acceptable levels (Section 7.3). This approach implies a level of proportionality wherein the principles of decision-making applied to each particular hazard are proportionate to the acceptability of environmental risk of that hazard.

Woodside considers lower-order (or 'Type A') impacts or risks as those that:

- are well understood
- are derived from standard, non-complex or routine operations familiar to Woodside
- there are clearly defined regulatory, corporate or industry (good practice) controls to manage the impact or risk
- have no concerns or objections from relevant stakeholders
- have a 'severity level' for planned operations (impacts) and unplanned events (risks) that does not exceed '2' based upon the severity level definition (Table 7-2)
- have a 'likelihood' for unplanned events that is either 'unlikely' or 'highly unlikely' based upon the likelihood definitions (Table 7-3).

Woodside considers higher-order (or 'Type B') impacts or risks as those that:

- are not well understood or there is some uncertainty
- are derived from complex operations not routinely performed by Woodside
- have regulatory, corporate or industry (good practice) controls that require additional definition or validation
- have had some concerns or objections raised by relevant stakeholders
- have a 'severity level' for planned operations (impacts) and unplanned events (risks) that is '3' based upon the Woodside severity level definition (Table 7-2)
- have a 'likelihood' for unplanned events that is considered 'probable' to 'highly likely' based upon the Woodside likelihood definitions (Table 7-3).

Woodside considers highest-order (or 'Type C') impacts or risks as those that:

- are not understood or there is a high degree of uncertainty
- are derived from operations not previously performed by Woodside
- have corporate or industry (good practice) controls that either do not exist or are insufficient to manage impacts or risks
- have had multiple concerns or objections raised by relevant stakeholders or lobby groups
- have a 'severity level' for planned operations (impacts) and unplanned events (risks) that is equal to or exceeds '4' based upon the Woodside severity level definition (Table 7-2)
- have a 'likelihood' for unplanned events that is considered 'probable' to 'highly likely' based upon the Woodside likelihood definitions (Table 7-3).

The decision-making principles described above are consistent with the precautionary principle (as defined in the EPBC Act) and provide assurance that the environmental impacts and risks are reduced to ALARP and of an acceptable level.

7.1.2 Environmental Impact Analysis

The environmental impact analysis is based on the environmental receptors identified in Section 5. Impact and risk descriptions are developed in an initial screening process that identifies the specific receptor that may be impacted. Quantitative or qualitative definition of the impact and risk may be completed to ensure an understanding of and to confirm the severity of the risk and impact.

7.1.3 Planned Activity Assessment

All planned activities were assessed as being a routine impact and defined as such in the ENVID. The description and degree of impact formed the basis for the severity rating applied, with a quantitative assessment of impact conducted where possible to ensure the impact was well understood and clearly categorised on the severity table. Where this was not possible, a robust qualitative assessment was completed and the severity rating assigned during the ENVID process in accordance with the Woodside HSE Risk Matrix, which is consistent with the Risk Management Severity Table (Table 7-2), taking into account any of the mitigative controls assigned. Given routine operations are planned, and impacts are mitigated by applying control measures, likelihood or residual risk ratings were not applied.

7.1.4 Unplanned Event Risk Assessment

Risk ranking of an unplanned event is the product of the consequence of an event (the severity) and the likelihood of that event occurring.

No credible unplanned events were identified that could credibly arise from the petroleum activities considered in this EP. The unplanned event risk assessment process described here is retained for context only.

Likelihood and potential severity ratings were assigned in accordance with the Woodside HSE Risk Matrix PHSE-03-PO1 (Table 7-1, Table 7-2 and Table 7-3), which allowed the risk of individual events to be categorised in a methodical and structured process. This was completed based upon judgement by the ENVID assessment team, with detailed potential impact descriptions used to ensure a robust and comprehensive decision.

The likelihood rating was based on the frequency of the source of hazard actually occurring with all preventative controls taken into consideration.

The potential severity rating was determined based on the potential impact that may occur once the source of hazard had occurred, taking into account any mitigative controls in place to reduce the impact.

Table 7-1: Risk matrix

Likelihood (multipliers in brackets)	Severity Level (multipliers in brackets)				
	1 (10)	2 (30)	3 (100)	4 (300)	5 (1,000)
Highly Likely (3)	30	90	300	900	3,000
Likely (1)	10	30	100	300	1,000
Probable (0.3)	3	9	30	90	300
Unlikely (0.1)	1	3	10	30	100
Highly Unlikely (0.03)	0.3	0.9	3	9	30

Table 7-2: Woodside severity level definitions

Severity	Severity Factor	Descriptor
5	1,000	• 6 of more fatalities or 6 or more life-shortening illnesses, or • Severe impacts to the environment and where recovery of ecosystem function takes 10 years or more, or • Severe impact on community lasting more than 12 months or a substantiated human rights violation impacting 6 or more people, or • Severe impact on company reputation, investment attractiveness, legal rights or compliance, social value proposition or ability to access opportunities at a global level, or • US$2 billion or more
4	300	• 1-5 fatalities or 1-5 life-shortening illnesses, or • Serious impacts to the environment, where recovery of ecosystem function takes between 3 and up to 10 years, or • Serious impact on community lasting 6-12 months or a substantiated human rights violation impacting 1-5 persons, or • Serious impact on company reputation, investment attractiveness, legal rights or compliance, social value proposition or ability to access opportunities at a national level, or • Between US$250 million and up to US$2 billion
3	100	• Permanent disability or life-altering injury or illness to one or more persons, or • Substantial impacts to the environment, where recovery of ecosystem function takes between 1 and up to 3 years, or • Substantial impact on the community lasting 2-6 months, or • Substantial impact on company reputation, legal rights or compliance, social value proposition, or ability to access opportunities at a sub-national level (state, territory, province), or • Between US$50 million and up to US$250 million
2	30	• Non-life-threatening / non-life-altering injuries or illnesses to one or more persons that results in lost time, restricted work or medical treatment, or • Measurable but limited impacts to the environment, where recovery of ecosystem function takes less than 1 year, or • measurable but limited community impacts lasting less than one month, or • Measurable but limited impact on company reputation, legal rights or compliance, or social value proposition at a local level (region, city, town), or • Between US$2 million and up to US $50 million
1	10	• First aid / low-level short-term subjective symptoms or inconvenience to one or more persons, or

Severity	Severity Factor	Descriptor
		• Minor, temporary impacts to the environment, where the ecosystem recovers with little intervention, or • Minor, temporary community impacts that recovers with little intervention, or • Minor, temporary impact on company reputation, legal right or compliance, or social value proposition, or • Less than US$2 million.

Table 7-3: Woodside likelihood definitions

Uncertainty	Frequency	Likelihood Factor
Highly Likely	Likely to occur within a 1-year period	3
Likely	Likely to occur within a 1 – 5-year period	1
Probable	Likely to occur within a 5 – 20-year period	0.3
Unlikely	Likely to occur within a 20 – 50-year period	0.1
Highly Unlikely	Not likely to occur within a 50-year period	0.03

7.2 Demonstration of As Low As Reasonably Practicable

Regulation 10A(b) of the Environment Regulations requires demonstration that the environmental impacts and risks of the activity will be reduced to ALARP.

7.2.1 Planned Activity and Unplanned Event As Low As Reasonably Practicable Evaluation

This section details the process for demonstrating ALARP for both planned routine operations and unplanned events.

Demonstrating ALARP for lower-order ('Type A') impacts or risks

When an impact or risk has been evaluated as 'lower-order' based upon the Decision Context detailed in Section 7.1.1, and identified regulatory, corporate and industry good practice controls are implemented, Woodside considers the impact or risk to be managed to ALARP and no further detailed engineering evaluation of controls is required. The application of feasible and readily implementable alternate, additional or improved controls may be adopted opportunistically when demonstrated to further reduce potential environmental impacts or risks.

Demonstrating ALARP for higher-order ('Type B') impacts or risks

When an impact or risk has been evaluated as higher-order based upon the Decision Context detailed in Section 7.1.1, in addition to relevant regulatory, corporate and industry good practice controls being implemented, alternate, additional or improved controls should be proposed and evaluated according to their feasibility, reasonableness and practicability to implement to further reduce the potential for impacts and risks associated with the petroleum activity. Woodside applies a cost and benefit analysis when evaluating additional controls and applies those that are both feasible and where the cost (safety, time, effort and financial) are not grossly disproportionate to the potential reduction in environmental impact or risk afforded by the control.

Demonstrating ALARP for highest-order ('Type C') impacts or risks

When an impact or risk has been evaluated as highest-order based upon the Decision Context detailed in Section 7.1.1, alternate, additional or improved controls over and above relevant regulatory, corporate and industry good practice must be proposed and evaluated based upon a precautionary approach, ensuring any and all feasible controls that have the potential to reduce environmental impacts and risks are implemented, when safe to do so and irrespective of the additional effort, time or financial cost associated with implementing the control.

When evaluating additional controls for 'Type B' and 'Type C' impacts and risks, Woodside has applied the hierarchy of controls as defined below and illustrated in Figure 7-2:

- Eliminate – Remove the source preventing the impact; in other words, eliminate the hazard.
- Substitution – Replace the source preventing the impact.
- Engineer – Introduce engineering controls to prevent or control the source having an impact.
- Separate – Separate the source from the receptor preventing impact.

- Administrate – Procedures, competency and training implemented to minimise the source causing an impact.
- Pollution Control – Implement a pollution control system to reduce the impact.
- Contingency Planning – Mitigate control reducing the impact.
- Monitor – Program or system used to monitor the impact over time.

The general preference is to accept controls that are ranked in the Tier 1 categories of Eliminate, Substitute, Engineer and Separate as these controls provide a preventive means of reducing the likelihood of the hazard occurring over and above Tier 2 controls.

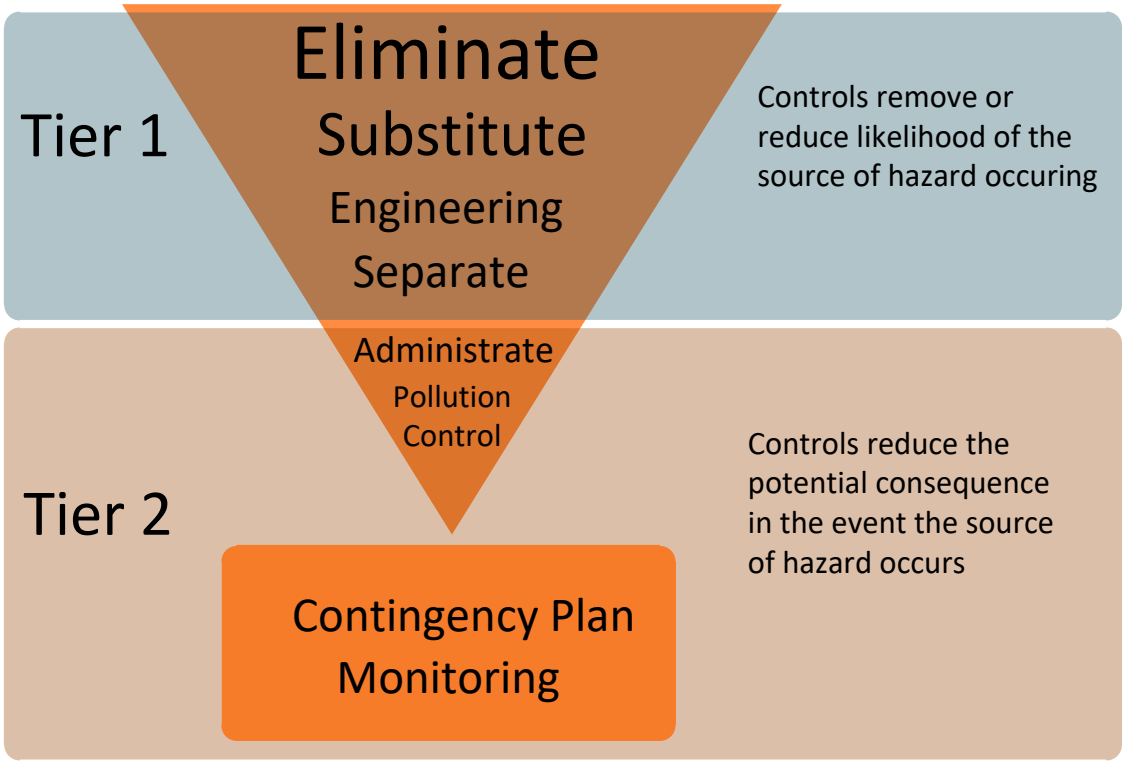

Figure 7-2: Hierarchy of control framework

7.3 Demonstration of Acceptability

Regulation 10A(c) of the Environment Regulations requires demonstration that the environmental impacts and risks of the activity will be of an acceptable (tolerable) level.

The demonstration of acceptability is completed independently of the ALARP evaluation described above. However, as with the demonstration of ALARP, the demonstration of acceptability detailed below applies the decision-making principles described in Section 7.1.1, ensuring consistency with the precautionary principle when considering the acceptable levels of impact and risk caused by the activity.

Demonstrating acceptability for lower-order ('Type A') impacts or risks

When an impact or risk has been evaluated as 'lower-order' based upon the Decision Context detailed in Section 7.1.1, and identified regulatory, corporate or industry good practice controls consistent with relevant actions prescribed in listed species recovery plans, conservation advice and threat abatement plans are implemented, and the application of these controls clearly indicate the aspect-specific Environmental Performance Outcomes (EPOs) can be achieved, Woodside considers the impact or risk to be managed to an acceptable level.

Demonstrating acceptability for lower-order ('Type A') and higher-order ('Type B') impacts or risks

When an impact or risk has been evaluated as 'higher-order' based upon the Decision Context detailed in Section 7.1.1, acceptability of the impact or risk is evaluated based upon the following criteria:

- Relevant regulatory, corporate and industry good practice controls have been identified and implemented, including consideration of relevant actions prescribed in recovery plans and approved conservation.
- The activity does not contravene any relevant Plan of Management for a World Heritage place, National Heritage place or Ramsar wetland identified within the EMBA.
- Any alternate, additional or improved controls adopted via the detailed engineering risk assessment have been or will be implemented to manage potential impacts and risks to ALARP.
- There are either no objections or claims made by relevant stakeholders for the aspect of the activity being assessed, or any objections or claims received from relevant stakeholders are assessed for merit and controls adopted to address the objections or claims where merited.
- Where industry good practice cannot be adopted, professional judgement made by subject matter experts have been used to evaluate the acceptability of potential environmental impact or risk based upon adoption of alternate, additional or improved controls identified during detailed engineering risk assessment.
- Consideration of relevant actions prescribed in listed species recovery plans, conservation advice and threat abatement plans have informed the development of control measures.
- The application of adopted controls clearly indicates the aspect-specific EPOs can be achieved.
- The proposed impact is consistent with the principles of ESD defined in Section 3A of the EPBC Act (Section 2.2.2), including:
  - Decision-making processes should effectively integrate both long-term and short-term economic, environmental, social and equitable considerations (the 'integration principle')
  - If there are threat of serious or irreversible damage lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation (the 'precautionary principle')
  - The principle of intergenerational equity- that the present generation should ensure the health, diversity and productivity of the environment is maintained or enhanced for the benefit of future generations (the 'intergenerational principle')
  - The conservation of biological diversity and ecological integrity should be a fundamental consideration in decision making ('the biodiversity principle').

In addition to the criteria above, given the environmental management approach adopted within this EP is consistent with both the APPEA Principles of Conduct and Our Requirements, Petroleum HSE Standard (PET-HSE00-HX-STD-00001) and HSE Management Systems, which endorse and promote continuous improvement in ways that protect people and the environment through the responsible management of petroleum activity and their impacts, Woodside considers that adherence to these principles, standards and systems aligns with the principles of ESD. Therefore, any deviation from these principles, standards and systems must be evaluated to ensure the potential environmental impacts and risks remain acceptable.

Demonstrating acceptability for highest-order ('Type C') impacts or risks

When an impact or risk has been evaluated as 'highest-order' based upon the Decision Context detailed in Section 7.1.1, the potential environmental impact or risk can only be deemed acceptable once the criteria for 'Type B' demonstration of acceptability detailed above has been met and:

- any alternate, additional or improved controls adopted via implementing a precautionary approach (consistent with the 'Precautionary Principle' as defined within Section 3A of the EPBC Act) can demonstrate residual impacts have been lowered, such that a severity level of '4' becomes 'unlikely' or the severity level of '5' becomes 'highly unlikely' based upon the Risk Matrix (Table 7-1).

7.4 Environmental Performance Outcomes, Environmental Performance Standards and Measurement Criteria

Regulation 10A(d) of the Environment Regulations requires the EP provides appropriate EPOs, environmental performance standards (EPSs) and measurement criteria (MC).

An objective of the EP is to ensure all activities are performed in accordance with appropriate EPSs, thus ensuring EPOs are achieved. This requires (among other things) appropriate measurement criteria for demonstrating the EPSs have been met as defined within the EP.

Establishing EPOs and EPSs involves a process of considering legal requirements and the environmental risks (described in the risk assessment presented in Sections 8) and considering available control options (Sections 8), and the views of interested parties (Section 6). The resulting outcomes and standards must be measurable where practicable and consistent with Our Values.

7.4.1 Environmental Performance Outcomes

EPOs are developed to ensure protection of the environment from the impact or risk and to ensure ongoing performance and measurability of the controls. These were developed using the below criteria:

- Be specific to the source of the hazard.
- Indicate how the environmental impact will be managed (for example, minimise or prevent).
- Contain a statement of measurable performance (where applicable).
- Contain a timeframe for action (where applicable).
- Be consistent with legislative and HSE requirements.

7.4.2 Environmental Performance Standards

An EPS is a statement of performance required from a control measure (a system, an item of equipment, a procedure or functional responsibility (person)), which is used as a basis for managing environmental impact and risk, for the duration of the activity.

There is a specific link between the EPOs, the EPSs and control measures; each EPO has one or more standards defining the performance requirement that needs to be met by a control measure to meet the EPO.

EPSs detailed within this EP are specific, measurable, and achievable.

7.4.3 Environmental Measurement Criteria

MCs have been assigned for each EPS as a means of validating that each EPO and EPS will be or has been met throughout the duration of the petroleum activity, thus continually reducing environmental impacts and risks to ALARP and acceptable levels.

All MCs are designed to be inspected or audited via compliance assurance activities and enable a traceable record of performance to be maintained.

EPOs, EPSs, and MCs, both in relation to planned activities and unplanned events, have been detailed throughout Section 8 and have been consolidated in the Environmental Performance section of this EP.

EPOs, EPSs, and MCs relating to Incident Management Team (IMT) capability and competency are detailed within the APU Incident Management Team Capability Assessment (AOHSE-ER-0071).

8 Environmental Impact Assessment and Evaluation: Planned Activities

The purpose of this section is to address the requirements of Regulations 13(5) and 13(6) of the Environment Regulations by assessing and evaluating all the identified impacts and risks associated with the petroleum activity and associated control measures that will be applied to reduce the impacts and risks to an ALARP and an acceptable level.

Table 8-1 summarises the impact analysis for the aspects associated with the planned activities. A comprehensive risk and impact assessment for each of the planned activities, and subsequent control measures proposed by Woodside to reduce the impacts and risks to ALARP and acceptable levels, are detailed in the subsections.

Table 8-1: Summary of the environmental impact analysis for planned activities

Aspect	Environmental								Socio-economic				Risk Assessment and Evaluation			
	Marine Mammals	Marine Turtles	Fish	Seabirds / Shorebirds	Seabed	Water Quality	Air Quality	Marine Protected Areas	Key Ecological Features	Commercial Fisheries	Shipping	Tourism / Recreation	Severity Factor	Likelihood Factor	Residual Risk	Acceptability
Physical Presence – Section 8.1																
Presence of subsea infrastructure					x					x			10	N/A	-	Tolerable
Equipment Degradation – Section 8.2																
Equipment abandoned *in situ*					x								10	N/A	-	Tolerable
Seabed Disturbance – Section 8.2																
Use and discharge of marine growth removal chemicals.						x							10	N/A	-	Tolerable

8.1 Physical Presence

8.1.1 Summary of Risk Assessment and Evaluation

Aspect	Source of Hazard	Potential Impact	Severity Factor	Likelihood Factor	Residual Risk	Decision Context	Acceptability
Physical presence	Presence of subsea infrastructure	Interaction with or displacement of other marine users (such as commercial fishing).	10	N/A	-	Type A Low Order Impact	Tolerable
		Scouring of the seabed around equipment	10	N/A	-	Type A Low Order Impact	Tolerable

8.1.2 Source of Hazard

8.1.2.1 Equipment Abandoned *In Situ*

The subsea equipment listed in Table 4-2 will be abandoned *in situ*, with all other equipment removed from the seabed. The equipment abandoned *in situ* is embedded within the seabed:

- The nine mooring anchors are embedded within the seabed, with minimal exposed portions
- The nine suction piles used to anchor the risers are predominantly embedded within the seabed.
- The suction pile used as a foundation for the water injection manifold, predominantly embedded within the seabed
- The Eskdale-1 wellhead

The anchors are buried within the sediment, with minimal exposed components. The suction piles for the riser holdback anchors and water injection manifold are mostly buried with a minor protrusion of equipment (approx. 0.75 m) above the seabed. The wellhead extends approximately between 2 m and 3 m above the seabed.

The equipment abandoned *in situ* will degrade over time, eventually becoming indistinguishable from the surrounding sediments. This process will take hundreds to thousands of years. Inspections to date (Section 4.6) indicate that the corrosion prevention systems on the equipment to be abandoned *in situ* are in good order. Based on degradation studies for the Griffin field (Atteris, 2019) the corrosion prevention systems, such as coatings and sacrificial anodes, will continue to function for decades. Corrosion of the steel will substantially increase following failure of the corrosion prevention systems.

Parts of the equipment that extend above the seabed (e.g., wellheads and the tops of suction piles) will corrode relatively quickly due to the higher availability of oxygen in the water column compared to the parts of the equipment embedded in the seabed. As the parts of the equipment above the seabed corrode to the point where structural integrity fails, they will slump to the seabed due to their weight, where they will gradually become buried over time through natural sedimentary processes. Wellheads have a high mass and will sink within the muddy sediments once they collapse. The timeframes for these corrosion and degradation processes will be in the order of hundreds of years.

The presence of the equipment abandoned *in situ* on the seabed may interact with other users of the sea, particularly trawled fishing gear.

The presence of equipment at the interface between the seabed and the water column may result in scour where bottom currents are sufficient to initiate sediment transport. This may result in disturbance to benthic habitats.

8.1.3 Environmental Impact Assessment

8.1.3.1 Commercial Fishing

The long-term physical presence of equipment on the seabed may result in interactions with trawl fishing gear. Snagging of trawled gear on subsea equipment has resulted in disruption to fishing operations and financial loss through loss of catch or damage to fishing equipment. Vessel damage or loss has occurred in less than 0.5% of snagging events and one vessel capsize in the UK between 1989 and 2016 (Rouse et al., 2020), however capsize is likely the result of attempts to release the snag. Most of the interactions analysed by Rouse et al. (2020) were between trawled gear and subsea equipment involved hydrocarbon pipelines. Pipelines pose a particular risk due to their relatively long extents and the development of free spans creating sites that trawl otter boards can become wedged under. Equipment that is embedded in the seabed with little or no protrusion above the seabed poses relatively little risk of snagging trawled fishing gear.

The wellhead poses the greatest risk of interaction with trawled fishing gear due to the height they extend above the seabed (between approximately 2 m and 3 m). The tops of the suction piles also pose a risk of interaction with trawled fishing gear; however, this risk is lower as they do not extend above the seabed to the same extent as the wellheads. The anchors and much of the suction piles and wellheads are embedded within the seabed. Embedded equipment (or parts of equipment) do not pose a credible risk of interaction with trawled fishing gear.

Several managed fishery boundaries overlap the operational area, each of which is described in Table 5-4. None of these fisheries are currently active, or have historically been active, in the operational area. Of the fisheries described in Table 5-4, only the Western Deep Water Trawl Fishery uses trawled gear which may interact with the equipment in WA-32-L. Effort in this fishery is concentrated off the central west coast, with Carnarvon and Fremantle the major landing ports. The primary species landed by the western deepwater trawl fishery occur in waters substantially shallower than the Stybarrow field:

- red snapper (*Etelis* spp.) approximately 30-300 m water depth (Allen, 1985)
- deepwater bugs (*Ibacus* spp.) <100 m water depth (Holthuis, 1991)

Environmental surveys in WA-32-L did not observe these species. On this basis, participants in the Western Deepwater Trawl Fishery will not credibly fish in the vicinity of equipment abandoned *in situ*, as the water depths far exceed the distribution of target species. Demersal or benthic biological resources that may be exploited by trawl fishers in the future were not observed within the Stybarrow field, hence trawl fishing is not expected to be viable within the vicinity of equipment abandoned *in situ* in the future.

Crystal crabs (*Chaceon albus*) targeted by the West Coast Deep Sea Crustacean may occur within the depth range of the Stybarrow field, however the other non-target species retained by this fishery are distributed in shallower waters. The West Coast Deep Sea Crustacean fishery is a trap-based fishery that is permitted to operate over the Stybarrow field. Traps have a much lower potential for interaction with equipment abandoned *in situ*, as they are not dragged across the seabed. The consequences of interaction are less than for trawled fishing gear (typically the loss of a single trap compared to the loss of a net). While the target species for the West Coast Deep Sea Crustacean fishery depth range overlaps the equipment that will be abandoned *in situ*, and the fishery is permitted to operate within the Stybarrow field, fishing effort to date is concentrated off the central west coast between Shark Bay and the Abrolhos Islands (Figure 8-1), several hundred kilometres from the equipment that will be abandoned *in situ*. Based on the historical fishing effort and the gear type used in the West Coast Deep Sea Crustacean Fishery, participants in the fishery will not credibly have interactions with the equipment abandoned *in situ*.

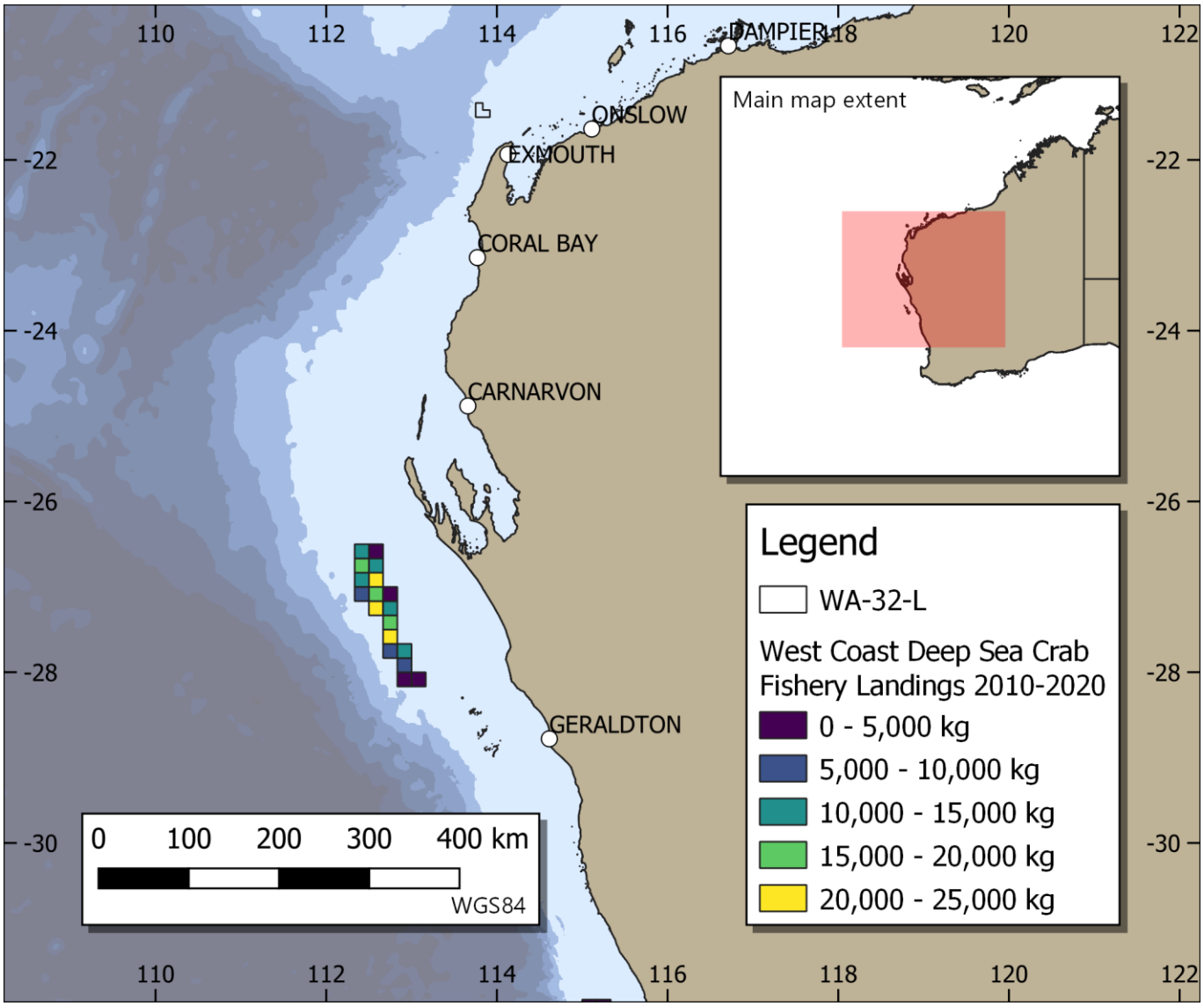

Figure 8-1: West Coast Deep Sea Crustacean Fishery landings between 2010 and 2020 (based on FishCube data supplied by Department of Primary Industries and Regional Development)

Commercial fishing vessels are equipped with navigational equipment such as echo sounders and Geographical Positioning System (GPS) plotters, which enables them to avoid charted infrastructure on the seabed. The likelihood of interactions between trawl equipment and oil and gas infrastructure has been reducing over time as a result of an increase in communication between the oil and gas industry and improvement in fishery GPS equipment (Rouse et al., 2020). Historical fishing vessel incident data from the AMSA Monthly Domestic Vessel Incident Reporting Database (2018-2021) and the Australian Transport Safety Bureau (ATSB) Marine Safety Investigation reports show there were no reported fishing vessel incidents related to offshore oil and gas infrastructure in Australia.

Given the negligible commercial fishing effort to date, the burial status of the equipment, and the absence of commercially important species in WA-32-L, no displacement of commercial fishers or interactions with fishing gear are expected.

8.1.3.2 Benthic Habitats

Scouring of the seabed occurs in areas where current speeds can initiate sediment transport, particularly due to the formation of vortices around equipment. This can result in localised depressions around infrastructure and disturbance to benthic habitats.

Observations in the Stybarrow field show no evidence of scouring during the operational phase. Depressions in the seabed from installation activities in 2005-2006 are still visible, indicating that bottom currents are not sufficient to initiate sediment transport. The water depth in the operational area is >800 m, which is too deep to be affected by high energy meteorological events, such as cyclones. As such, scouring around equipment abandoned *in situ* will not credibly occur.

8.1.4 Demonstration of As Low As Reasonably Practicable

The ALARP process performed for the environmental aspect is summarised in Table 8-2. This process was completed as outlined in Section 7.2 and included consideration of all controls, analysis of the risk reduction proportional to the benefit gained, and final acceptance or justification if the control was rejected.

Table 8-2: Physical presence - as low as reasonably practicable summary

Hierarchy of Control	Control Measure	Accept / Reject	Reason	Associated Performance Standards
Engineer	Install trawl protection structures over the equipment abandoned *in situ*	Reject	Given the absence of trawl fishing and the burial status of the equipment abandoned *in situ*, the installation of trawl protection would result in no reduction of the risk of trawled fishing gear being snagged. The installation of trawl protection equipment would introduce additional manmade materials to the marine environment.	-
	Fully remove equipment	Reject	Full removal of the equipment, which is embedded in the seabed, would involve substantial environmental disturbance. The decommissioning alternatives environmental impact assessment (Section 3) demonstrates that abandonment *in situ* of the anchors and suction piles results in equal or better environmental outcomes compared to full removal.	-
Administrate	Navigational charting of infrastructure	Accept	Legislative requirements to be followed which reduces the risk of third-party vessel interactions. Subsea infrastructure charting on AHO Nautical Charts allows other users to be aware of its presence. Control is feasible, standard practice with minimal cost. Benefits outweigh any cost sacrifice.	**PS 7.1.1**
	Consultation with relevant stakeholders	Accept	Controls based on Woodside requirements must be	**PS 7.1.2**

Hierarchy of Control	Control Measure	Accept / Reject	Reason	Associated Performance Standards
			accepted. Control ensures other users are informed and aware of the petroleum activity, thereby reducing the likelihood of interference. Control is feasible, standard practice with minimal cost. Benefits outweigh any cost sacrifice.	

8.1.4.1 ALARP Summary

The risk assessment and evaluation has identified a range of controls (Table 8-2) that, when implemented, are considered to manage the impacts of the physical presence of equipment abandoned *in situ* on other marine users to ALARP.

Woodside considers the control measures described above are appropriate to reduce the potential for interaction with other marine users associated with the physical presence of equipment abandoned *in situ*. Additional reasonable control measures were identified in Table 8-2 to further reduce impacts but rejected since the associated cost or sacrifice was grossly disproportionate to any benefit. The impacts are therefore considered reduced to ALARP.

8.1.5 Demonstration of Acceptability

Given the adopted controls, the physical presence of equipment abandoned *in situ* will not result in potential impacts greater than temporary and minor displacement of commercial fisheries. Further opportunities to reduce the impacts have been investigated in Table 8-2.

The adopted controls are considered good oil-field practice/industry best practice. No concerns or objections regarding the physical presence of equipment abandoned *in situ* have been raised by relevant stakeholders. The environmental impacts meet the environmental risk acceptability criteria (Section 7.3). The environmental impacts are consistent with the principles of ESD:

- Integration principle: Woodside has undertaken a range of studies to determine the approach to decommissioning the Stybarrow field, which have informed Woodside's deliberations. The decommissioning strategy being pursued by Woodside integrates long-term and short-term economic, environmental, social, and equitable considerations.
- Precautionary principle: The physical presence aspect, and its potential impacts, are well understood, and there is no risk of serious or irreversible environmental damage from this aspect.
- Inter-generational principle: The physical presence aspect will not impact upon the environment such that future generations cannot meet their needs.
- Biodiversity principle: The physical presence aspect will not impact upon biodiversity or ecological integrity.

Woodside considers the impact to be managed to an acceptable level.

8.1.6 Environmental Performance Outcome, Performance Standards and Measurement Criteria

Table 8-3: Environmental performance outcomes, performance standards and measurement criteria for physical presence - interaction with other users

Environmental Performance Outcome	Performance Standard	Measurement Criteria
No unplanned interactions between equipment abandoned *in situ* and other marine users	**PS 7.1.1** Subsea infrastructure is charted on AHS Nautical Charts.	AHS Nautical Charts show subsea infrastructure.
	PS 7.1.2 Woodside consultation with relevant stakeholders to advise them of the petroleum activity.	Stakeholder communication recorded in database demonstrating assessment of stakeholder feedback received and Woodside's response.

8.2 Equipment Degradation

8.2.1 Summary of Risk Assessment and Evaluation

Aspect	Source of Hazard	Potential Impact	Severity Factor	Likelihood Factor	Residual Risk	Decision Context	Acceptability
Equipment degradation	Equipment abandoned *in situ*	Localised increased concentrations of degradation products in sediments.	10	N/A	-	Type A Low Order Impact	Tolerable

8.2.2 Source of Hazard

8.2.2.1 Equipment Abandoned *In Situ*

Corrosion and breakdown or equipment abandoned *in situ* over time will release materials to the marine environment. The anchors, suction piles and wellheads are made of steel and are coated with paint for corrosion protection. Wellheads may have very small amounts of synthetic polymers in seals, expected to be <1 kg per wellhead. Steel will contain trace amounts of alloying materials, with typical concentrations of these derived from a materials analysis for a suction pile provided in Table 8-4. Of the alloying materials listed in Table 8-4, only three have established guideline values for toxicity in marine sediments in the *Australian and New Zealand Guidelines for Fresh and Marine Water Quality* (Commonwealth of Australia and New Zealand Government, 2018):

- Copper (0.14% of steel composition)
- Chromium (0.10% of steel composition)
- Nickel (0.06% of steel composition)

Each of these metals only occurs in trace amounts as alloying material. The absence of default guideline values for most of the alloying materials in Table 8-4 does not indicate they have no potential for toxicity. However, the evidence-based approach used to develop the *Australian and New Zealand Guidelines for Fresh and Marine Water*

Quality (Commonwealth of Australia and New Zealand Government, 2018) indicates that these materials pose negligible environmental risk at the concentrations found in the steel alloy.

Table 8-4: Indicative percentage composition of alloying materials in suction pile low carbon steel

Alloying Material	Percentage Composition (%)	Default Guideline Value (DGV) (mg/kg)	High Guideline Value (GV-High) (mg/kg)
Manganese	1.23	No guideline	No guideline
Cerium	0.42	No guideline	No guideline
Silicon	0.25	No guideline	No guideline
Carbon	0.18	No guideline	No guideline
Copper	0.14	65	270
Chromium	0.10	80	370
Nickel	0.06	21	52
Aluminium	0.052	No guideline	No guideline
Molybdenum	0.02	No guideline	No guideline
Phosphorus	0.018	No guideline	No guideline
Sulphur	0.017	No guideline	No guideline
Niobium	0.002	No guideline	No guideline
Titanium	0.002	No guideline	No guideline
Boron	0.0004	No guideline	No guideline
Vanadium	0.000	No guideline	No guideline

The equipment abandoned *in situ* is largely buried in sediments which have very low levels of oxygen compared to the water column. This will result in relatively slow corrosion degradation due to the limited supply of oxygen. The top sections of the suction piles and wellheads will be exposed to relatively high levels of oxygen in the water column and hence will degrade more quickly. As described in Section 8.1.2, the degradation process is expected to take hundreds to thousands of years.

As most of the equipment is buried, the degradation products will be trapped within the sediments surrounding the equipment. The sedimentary environment is depositional (Baker et al., 2008) and hence these buried degradation products will not be mobilised, but will remain deposited in the sediment.

Degradation products from the parts of the suction piles and wellheads above the seabed are likely to detach as flakes <5 cm, which will rapidly fall to the seabed as the density of the degradation products is substantially greater than seawater. The flakes will become embedded in the sediment and become buried over time through natural sedimentation. This will result in a localised debris field of degradation products in the upper layer of sediment around the suction piles and wellheads developing over the course of hundreds of years.

Steel degradation will result in rust flaking off the equipment into the surrounding sediments. This process will occur over hundreds to thousands of years for the buried equipment due to the lack of oxygen on sediments. Degradation products from the steel will remain in the immediate area and be incorporated into the seabed due to the significantly higher density than seawater and burial of the equipment.

Much of the equipment to be abandoned *in situ* has a paint coating as part of the corrosion protection system. The coatings are not anti-fouling coatings and do not contain compounds such as tributyltin or copper-based antifouling compounds. Paint coatings were applied to a thickness of approximately 500 µm.

The entire surface of the anchors were painted. The majority of the pile surface embedded in the seabed, including the entire interior surface of the piles, was not painted in order to enhance friction between the pile and the seabed, resulting in greater holding capacity.

Paint coatings will degrade and be released to the environment as equipment degrades and will be released relatively early in the degradation timeline. Paint flakes are denser than seawater and will become incorporated into the sediment surrounding the equipment.

8.2.3 Environmental Impact Assessment

8.2.3.1 Steel

Rust from corrosion of steel will be deposited in the sediments immediately around the equipment. This will occur over a prolonged period of time (hundreds to thousands of years). Steel is made up of 98.5% iron, which is not considered a significant contaminant in the marine environment and is only toxic to marine organisms at high concentrations and the *Australian and New Zealand Guidelines for Fresh and Marine Water Quality* (Commonwealth of Australia and New Zealand Government, 2018) do not provide trigger values for iron in sediments. Iron is one of the most abundant elements in the Earth's crust.

The majority of the rust deposited in the sediments will be below the top 20-30 cm of sediments where infauna and epifauna occur. Rust below this depth will not credibly interact with marine fauna and will not result in biological impacts. The depositional environment will render degradation products below the top 20-30 cm of sediments harmless to fauna.

Rust from the upper sections of the suction piles and wellheads will be concentrated around the equipment. The bottom currents in the Stybarrow field are insufficient to remobilise rust that has flaked off equipment (evidenced by sediment disturbance from equipment installation in 2007 being clearly visible during recent inspections). The release of rust is expected to occur over a period of hundreds of years at the equipment degrades. As a result, the concentrations of potential contaminants will increase gradually over time until the upper parts of the suction piles and wellheads are completely degraded. Most of the alloying compounds in the steel are not recognised toxicants, with the exception of copper, chromium and nickel (Table 8-4). Alloying compounds represent a very small portion of the total steel mass and will be released over a long period of time.

The increased concentrations of potential contaminants from degradation of the exposed portions of the suction piles and wellheads will result in a localised, minor change in sediment quality. This may result in changes to infauna and epifauna assemblages within the surface sediments, however this would only affect a very small area due to the localised nature of the contamination. Sediment quality values, infauna and epifauna that may be impacted are very widely represented in the region and not of particular conservation significance.

The equipment that will be abandoned *in situ* lies within the Continental Slope Demersal Fish Communities and Canyons linking the Cuvier Abyssal Plain and the Cape Range Peninsula KEFs. The environmental values of the Continental Slope Demersal Fish Communities and Canyons comprise demersal fish assemblages. These fish assemblages will not credibly be impacted by potential contaminants in sediments as a result of degradation. Components of these fish assemblages may feed upon infauna and epifauna that have been exposed to sediments contaminated by rust, however this is not expected to impact upon fish assemblages due to the highly localised areas of contamination and the non-site attached nature of most fish that comprise the assemblage. The environmental values of the Canyons linking the Cuvier Abyssal Plain KEF are geomorphic in nature and relate to potential upwelling (and associated productivity) that may result from the canyons. The abandonment *in situ* of the anchors, suction piles and wellheads will not impact upon these values.

Given the lack on sensitive biological communities within the Stybarrow field, impacts from degradation of equipment abandoned *in situ* are unlikely to result in an impact greater than a localised, long term and minor change in sediment quality within the operational area.

8.2.3.2 Paint

The mass of paint that would be released to the environment is very small compared to the mass of steel. The relatively small amount of paint released to the environment may result in localised sediment contamination. The nature and scale of this contamination is expected to be smaller than that from rust of steel structures. The paint does not contain anti-fouling compounds and would result in negligible impacts to infauna and epifauna around the equipment.

8.2.3.3 Species Recovery Plans and Threat Abatement Plans

Woodside has considered information contained in relevant recovery plans and approved conservation advice for that identify marine debris and changes in sediment quality as a threat (Section 9).

8.2.4 Demonstration of As Low As Reasonably Practicable

The ALARP process for the environmental risk is summarised in Table 8-5. This process was completed as outlined in Section 7.1 and included consideration of all controls, analysis of the risk reduction proportional to the benefit gained and final acceptance or justification if the control was rejected.

Table 8-5: Equipment degradation - as low as reasonably practicable summary

Hierarchy of Control	Control Measure	Accept / Reject	Reason	Associated Performance Standards
Engineer	Fully remove equipment	Reject	Full removal of the equipment, which is embedded in the seabed, would involve substantial environmental disturbance. The decommissioning alternatives environmental impact assessment (Section 3) demonstrates that abandonment *in situ* of the anchors and suction piles results in equal or better environmental outcomes compared to full removal.	-
Administrate	Environmental monitoring of the seabed to assess any impacts to the seabed from subsea infrastructure breakdown	Reject	The degradation of equipment abandoned *in situ* will occur over a period of hundreds to thousands of years. The rate of change in the environment will be slow and unlikely to be easily detected until substantial degradation has occurred. Given the timeframe for breakdown of materials, ongoing monitoring is impractical. Monitoring alone will not change the environmental outcome of degradation. The degradation of equipment is reliably predicted and will not result in unacceptable impacts.	-

Hierarchy of Control	Control Measure	Accept / Reject	Reason	Associated Performance Standards
			The cost of this control is grossly disproportionate to the environmental benefit.	

8.2.4.1 ALARP Summary

The risk assessment and evaluation has identified a range of controls (Table 8-5). No controls were adopted, as the impact from degradation of equipment abandoned *in situ* are inherently ALARP.

8.2.5 Demonstration of Acceptability

Degradation of equipment abandoned *in situ* will not result in potential impacts greater than temporary and minor reduction in sediment quality. This impact is considered inherently acceptable. Further opportunities to reduce the impacts have been investigated in Table 8-5.

No concerns or objections regarding subsea discharge impacts have been raised by relevant stakeholders. Woodside has considered information contained in recovery plans and threat abatement plans (Section 9). The environmental impacts meet the Woodside environmental risk acceptability criteria (Section 7.3). The environmental impacts are consistent with the principles of ESD:

- Integration principle: Woodside has undertaken a range of studies to determine the approach to decommissioning the Stybarrow field, which have informed Woodside's deliberations. The decommissioning strategy being pursued by Woodside integrates long-term and short-term economic, environmental, social, and equitable considerations.
- Precautionary principle: The subsea discharges aspect, and its potential impacts, are well understood, and there is no risk of serious or irreversible environmental damage from this aspect.
- Inter-generational principle: The subsea discharges aspect will not impact upon the environment such that future generations cannot meet their needs.
- Biodiversity principle: The subsea discharges aspect will not impact upon biodiversity or ecological integrity in the long-term.

Woodside considers the impact to be managed to an acceptable level.

8.2.6 Environmental Performance Outcome, Performance Standards and Measurement Criteria

There are no environmental performance outcomes, standards or measurement criteria are required. The impacts from degradation of equipment abandoned *in situ* are inherently acceptable and ALARP.

9 Recovery Plan and Threat Abatement Plan Assessment

This section provides an assessment to demonstrate that the petroleum activity are not inconsistent with any relevant recovery plans or threat abatement plans. Woodside has reviewed the recovery plans for threatened fauna that may occur within the operational area. No aspects of the petroleum activity were identified as threats in these recovery plans. Woodside considered the *Threat Abatement Plan for the Impacts of Marine Debris on the Vertebrate Wildlife of Australia's Coasts and Oceans* (Commonwealth of Australia, 2018), which has objectives relating to the reduction of marine debris in Australian waters. The objectives of this plan relate to buoyant debris, primarily plastics. The petroleum activity is consistent with the objectives of this plan given:

- there are no plastics in the equipment being abandoned *in situ*
- degradation products are negatively buoyant and will be sequestered within the sediment
- the water depth precludes air-breathing fauna from interacting with degradation products.

10 Implementation Strategy

In accordance with Regulation 14 of the Environment Regulations, the EP must contain an implementation strategy for the petroleum activity and monitoring, recording and reporting arrangements. The implementation strategy presented in this section provides specific practices and procedures to ensure:

- all the environmental impacts and risks of the petroleum activity will be continually identified and reduced to a level that is ALARP
- control measures identified in the EP are effective in reducing the environmental impacts and risks of the activity to ALARP and acceptable levels
- environmental performance outcomes and environmental performance standards are met
- arrangements are in place to respond to and monitor impacts of oil pollution emergencies
- arrangements for ongoing consultation with relevant authorities, persons and organisations are in place and maintained through the activities.

10.1 Systems, Practices and Procedures

10.1.1 Woodside Petroleum Health, Safety and Environment Management Systems

The HSE Management System defines the boundaries within which all activities are conducted. It provides a structured framework to set common requirements, boundaries, expectations, governance and assurance for all activities. It also supports accountabilities and responsibilities as defined in the organisational structure. The overarching objective of the HSE Management System is to aspire to zero harm to people, communities and the environment, and achieve leading industry practice. The structure of the HSE Management System is hierarchical (Figure 10-1).

Figure 10-1: HSE Management System

The documents in Figure 10-1 address specific areas (for example, corporate performance reporting, risk management, incident investigation) where it is important activities are conducted consistently across the organisation.

The top level of the triangle shown in Figure 10-1 is the Our Values which details Woodside's values and directs the approach to all activities in Woodside. It includes value statements about sustainability, integrity, respect, performance, simplicity and accountability. It also provides a means of aligning Woodside's values with strategic direction and measures of success. Our Values is supported by Woodside's Code of Business Conduct.

The HSE Management System establishes the foundation for continual improvement through applying consistent requirements across all aspects of the petroleum activity, including:

– identifying statutory obligations and commitments to maintain a licence to operate

– implementing petroleum risk management processes, including this EP

– establishing and maintaining the competencies for personnel and providing training to promote expected behaviours

– managing all contractors and suppliers of petroleum goods and services

– completing reviews and reporting outcomes of these reviews.

The HSE Standard details the mandatory HSE performance requirements as described in the HSE-related Our Requirements and are met through the HSE Management System. They address specific performance requirements that define functional and governance expectations. The controls apply to the entire lifecycle of petroleum activity, processes and products. Contractors are required to comply with the controls, and partners and suppliers are encouraged to adopt the intent and nature of the performance requirements. The controls are regularly monitored through scheduled audit and verification activities and cover the broad areas of:

- hazards and risk management
- crisis and emergency management
- security
- health and hygiene
- aviation
- marine operations
- fatal risks
- environment
- data reporting.

10.2 Environment Plan Organisation, Roles and Responsibilities

A defined chain of command with the roles and responsibilities for key Woodside and contractor personnel in relation to EP implementation, management and review are described in Table 10-1. It is the responsibility of all Woodside employees and contractors to ensure the HSE-related Our Requirements and the Woodside's "Our Values" (Appendix A) are applied in their areas of responsibility.

Table 10-1: Key personnel and environmental responsibilities

Title	Environmental Responsibilities
Office-based Roles	
Operations Manager	• Ensure compliance with Our Values and Management Standards • Ensure sufficient resources are provided to implement the commitments made in this EP

Title	Environmental Responsibilities
	• Provide vessel contractors with the EP and make them aware of the requirements for their activities • Ensure HSE incidents are reported to regulatory authorities as required • Assist the IMT in developing a response strategy in the event of a spill incident
Director of Projects Australia	• Have Technical Authority and manage team of projects and decommissioning professionals • Ensure sufficient resources are provided to implement the commitments made in this EP
Decommissioning Engineering Manager (or equivalent)	• Supervise decommissioning operations, including management of change • Be accountable for developing the decommissioning engineering and associated programs • Ensure compliance with company policies, standards and statutory requirements
Regional HSE Lead	• Ensure compliance with Management Standards, this EP and regulatory responsibilities • Ensure incident prepared and response arrangement meet Woodside and regulatory requirements • Ensure environmental incidents or breaches of EPOs, EPSs or MCs are reported in line with Woodside's incident reporting requirements
HSE Specialist	• Liaise with the Operations Manager, Projects Team and Vessel Master to ensure compliance to legislation, procedures, standards and commitments • Perform environmental education and ensure HSE inductions completed • Ensure compliance with this EP, regulatory and HSE responsibilities • Participate in the hydrocarbon spill response drills • Complete environmental audits to ensure compliance with this EP • Report environmental recordable incidents to NOPSEMA

10.3 Training and Competency

Training is not relevant to this EP on the basis that there will be no field activities, vessel-based activities or contractor engagement required to implement the EP.

10.4 Oil Pollution Emergency Plan

There are no credible scenarios that may arise from the petroleum activities that would result in the release of hydrocarbons. Hence, there is no requirement for an oil pollution emergency plan for this EP.

10.5 Monitoring, Auditing and Management of Non-conformance and Review

10.5.1 Addressing Arrangements for Long-term Monitoring

The *Guideline: Offshore petroleum decommissioning* (Department of Industry, Science, Energy and Resources, 2022), *Section 572 Maintenance and Removal of Property* (NOPSEMA, 2020) policy and draft *Section 270 NOPSEMA Advice - Consent to Surrender Title* (NOPSEMA, 2021) policy describe the requirement for titleholders to address arrangements for long-term monitoring of equipment abandoned in situ. These arrangements are addressed in this section.

Woodside's approach to monitoring is intended to:

- Confirm the condition of the equipment abandoned *in situ* at the time of abandonment

- Credibly predict the future condition of the equipment as it degrades
- Determine if additional risk management is required if the assumptions made in the impact assessment are found to be incorrect.

No ongoing monitoring has been proposed under this EP. This is on the basis that monitoring is not required to manage impacts associated with abandoning equipment *in situ*.

10.5.1.1 Confirming the Condition at the Time of Abandonment

Woodside has routinely undertaken inspections of the equipment in the Stybarrow field during the operational and cessation of production phases.

A single ROV survey will be undertaken on the equipment abandoned *in situ* and will be provided to NOPSEMA to meet the requirements of NOPSEMA General Direction (833), which requires:

'Provide, to the satisfaction of NOPSEMA, for the conservation and protection of the natural resources in the title areas within 12 months after property referred to in direction 1 is removed'

and

'Make good, to the satisfaction of NOPSEMA, any damage to the seabed or subsoil in the title areas caused by any person engaged or concerned in the operations authorised by the titles within 12 months after property referred to in direction 1 is removed'

The ROV survey is within the scope of the Stybarrow Decommissioning and Field Management EP (BHPB-00SC-N000-003).

10.5.1.2 Predicting the Future Condition of the Subsea Infrastructure Left in situ

Materials will be released to the environment as they degrade. As determined in Section 8.2, these materials do not pose credible risk of toxic effects in the marine environment and their impacts on the environment are reliably predicted to not result in unacceptable impacts. As such, monitoring of equipment degradation or degradation products in sediments or biota (e.g., fishes) is not warranted.

Based on the outcomes of surveys during the operational and cessation of production phases, the corrosion assessment, Woodside is confident that the equipment abandoned *in situ* is stable and will not move. No long-term monitoring to confirm the position of the equipment is warranted.

10.5.1.3 Determining if Additional Mitigation is Required

The existing environment in which the equipment will be abandoned has not been subject to trawl fishing. The only fishery in the region that uses trawled gear in the water depths within the Stybarrow field is the Western Deepwater Trawl Fishery. Effort in this fishery is concentrated far from the operational area. The burial status of the equipment poses negligible risk of snagging trawled fishing gear.

Other fishing methods targeting demersal scalefish, such as lines and traps, have very little potential to interact with the equipment once abandoned *in situ* and are not used in the water depths of the operational area.

Woodside will monitor for potential interactions with fishers by continuing to monitor the management arrangements for fisheries using trawled gear in the region. If these arrangements change such that there is an increased risk of interactions with the equipment in the Stybarrow field, Woodside will consult further to inform fishers that the anchors and foundation should be avoided.

10.6 Reporting

10.6.1 Routine Reporting (External)

An environmental performance report required by Regulation 14 (2) and 26C of the Environment Regulations will be submitted within three months of submission of acceptance of this EP, detailing that the environmental performance standards in the EP have been met and closed out.

Whilst ongoing monitoring has been determined not to be required based on the ALARP assessment and the acceptability of the impacts described in this EP, an as-left ROV survey will be undertaken of the equipment abandoned *in situ* will be completed as part of equipment removal activities detailed in the Stybarrow Decommissioning and Field Management EP (BHPB-00SC-N000-003). Footage will be provided to NOPSEMA under that EP to meet the requirements of NOPSEMA General Direction (833), which requires:

'Provide, to the satisfaction of NOPSEMA, for the conservation and protection of the natural resources in the title areas within 12 months after property referred to in direction 1 is removed'

and

'Make good, to the satisfaction of NOPSEMA, any damage to the seabed or subsoil in the title areas caused by any person engaged or concerned in the operations authorised by the titles within 12 months after property referred to in direction 1 is removed'.

10.6.2 Incident Reporting (Internal)

Woodside employees and contractors are required to report all environmental incidents and non-conformance with commitments made in the EP. It is the responsibility of the Regional HSE Lead to ensure reporting of environmental incidents meets both regulatory reporting requirements and HSE Standard.

1SAP is used for recording and reporting these incidents. Detailed investigations are completed for all actual and high-potential environmental incidents. The classification, reporting, investigation, and actioning of all incidents, including environmental, are performed in accordance with the Event and Investigation Management Protocol. Incident (potential or actual) corrective actions are monitored using 1SAP.

10.6.3 Incident Reporting (External) – Reportable and Recordable

10.6.3.1 Reportable Incidents

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

"…reportable incident, for an activity, means an incident relating to the activity that has caused, or has the potential to cause, moderate to significant environmental damage".

Reportable incidents for the petroleum activity include those that have been identified through the risk assessment process as having a severity (consequence) level of ≥ 3 (refer to Table 7-2). None of the environmental impacts and risks credibly arising from the petroleum activities in this EP can result in a severity (consequence) level of ≥ 3. Therefore, reportable incidents will not credibly occur.

10.6.3.2 Recordable Incident

A recordable environmental incident is defined in Regulation 4 of the Environment Regulations as:

"…recordable incident, for an activity, means a breach of an environmental performance outcome or environmental performance standard, in the environment plan that applies to the activity, that is not a reportable incident".

In terms of the activities within the scope of this EP, a recordable incident is a breach of the environmental performance outcome or environmental performance standards listed in this EP.

In the event of a recordable in recordable incident, Woodside will report the occurrence to NOPSEMA as soon as is practicable after the end of the calendar month in which it occurs; and in any case, not later than 15 days after the end of the calendar month. If no recordable incidents have occurred, a 'nil incident' report will be submitted to NOPSEMA. Written reporting to NOPSEMA of recordable incidents and 'nil incidents' can be via completion of NOPSEMA's Form FM0928– Recordable Environmental Incident Monthly Report. The report will contain:

- a record of all the recordable incidents that occurred during the calendar month
- all material facts and circumstances concerning the recordable incidents that are known or can, by reasonable search or enquiry, be found out
- any action taken to avoid or mitigate any adverse environmental impacts of the recordable incidents

- the corrective action that has been taken, or is proposed to be taken, to stop, control or remedy the recordable incident
- the action that has been taken, or is proposed to be taken, to prevent a similar incident occurring in the future.

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Appendix A. Woodside “Our Values”

OUR VALUES

One team

We are inspired by our common purpose.

We challenge, respect, and back each other.

We are inclusive, value diversity, and can be ourselves.

We care

We keep each other safe.

We listen and respond with humility.

We respect the environment, operate responsibly, and care for communities.

We adapt to the world's expectations of us.

Innovate every day

We explore ideas, find creative solutions, and try new ways of doing things to provide the energy the world needs today and low-cost, lower-carbon energy for tomorrow.

Results matter

We go after opportunities and show courage by taking the right risks and learning from our mistakes.

We spend and invest as if it's our money.

We are proud of our achievements.

Build and maintain trust

Trust takes time and effort and will not be taken for granted.

We nurture relationships and act with integrity – doing what we say and doing it well.

PART OF A BETTER FUTURE

Woodside Energy

Appendix B. Relevant Legislation, Regulations and Other Requirements

Legislation or Regulation	Description	Relevant
Corporations Act 2001	This Act is the principal legislation regulating matters of Australian companies, such as the formation and operation of companies, duties of officers, takeovers and fundraising.	The titleholder has provided ACN details within the meaning of the Act.
Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act) Environment Protection and Biodiversity Conservation Regulations 2000	Commonwealth Department of Sustainability, Environment, Water, Population & Communities administers Act that provides legal framework to protect and manage nationally and internationally important flora, fauna, ecological communities and heritage places—defined in the EPBC Act as matters of national environmental significance (NES). These include nationally threatened species and ecological communities, migratory species and Commonwealth marine areas. The Act regulates assessment and approval of proposed actions likely to have a significant impact on a matter of NES. The approval decision is made by a delegate of the Australian Government Environment Minister. Regulations provide for a wide range of detail essential for the operation of the Act, including regulations relating to management of Commonwealth reserves, information requirements for assessment processes, enforcement, granting of various permits, publication requirements and criteria that need to be met in relation to a wide variety of decision-making processes provided for under the Act.	This Act applies to all aspects of the activity that have the potential to impact MNES. NOPSEMA manages compliance with the relevant regulations and plans under the Act for this EP. Where activities have existing approvals under the Act, these will continue to apply.
Environment Protection (Sea Dumping) Act 1981 Environment Protection (Sea Dumping) Regulations 1983	The Act regulates the dumping at sea of controlled material (including certain wastes and other matter), the incineration at sea of controlled material, loading for the purpose of dumping or incineration, export for the purpose of dumping or incineration, and the placement of artificial reefs. Permits are required for any sea dumping activities. Operational discharges from vessels are not defined as 'dumping' under the 1996 Protocol to the Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter, 1972 and therefore not regulated under the Act.	Prior to permanently leaving any structure in-situ, Woodside will obtain a Sea Dumping Permit in accordance with the requirements of the Sea Dumping Act.
Offshore Petroleum and Greenhouse Gas Storage Act 2006	Legislation concerning Australian offshore petroleum exploration & production in Commonwealth Waters. National Offshore Petroleum Safety and Environmental Management Authority (NOPSEMA) is an independent safety and environmental management Authority funded by levies on industry participants and regulates matters with powers conferred directly from OPGGS Act and via Regulations concerned with: occupational health & safety law at facilities and offshore operations under Schedule 3 environmental management structural integrity of Wells under Resource management regulations.	Applies to all aspects of petroleum activities.

Legislation or Regulation	Description	Relevant
Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2009	Regulations administered by NOPSEMA to ensure offshore petroleum activity is carried out in a manner consistent with the principles of ecologically sustainable development and in accordance with an accepted environment plan, in particular: assessment of EPs, including associated OPEPs (previously oil spill contingency plans) investigation of accidents, occurrences and circumstances with regard to deficiencies in environmental management.	Applies to environmental maangement of petroleum activities.
Offshore Petroleum and Greenhouse Gas Storage (Regulatory Levies) Act 2003	Act to impose levies relating to the regulation of offshore petroleum activities, including well levies and environment plan levy.	A levy will be applied to the petroleum activities under this EP.

Industry Standards, Codes of Practice, Guidelines and Commonwealth Guidance Material
NOPSEMA (2012). Control Measures and Performance Standards Guidance Note. N040300-GN0271 Revision No. 4. December 2012
NOPSEMA Guidance note: Environment plan content requirements – (GN1344) 11.9.2020
NOPSEMA Guidance note: Notification and reporting of environmental incidents – (GN0926) 8.6.2020
NOPSEMA Guidance note: ALARP – Rev 6 (GN0166) (2015)
NOPSEMA Policy: Environment plan assessment - (PL1347) 19.5.2020
NOPSEMA Guideline: Environment plan decision making – Rev 7 (GL1721) (2021)
NOPSEMA Guideline: Making submissions to NOPSEMA – (GL0255) 4.5.2020
NOPSEMA Guideline: Consultation with Commonwealth agencies with responsibilities in the marine area
NOPSEMA Bulletin #2: Clarifying Statutory Requirements and Good Practice Consultation – Rev 0 (A696998) (2019)

Appendix C. Existing Environment and Protected Matters Search Tool Reports

Contents

List of Tables

List of Figures

1 Introduction

This Appendix describes the environment that may be affected (EMBA), including relevant values and sensitivities, by the environmental aspects associated with proposed end state decommissioning within the Stybarrow Field. The level of detail is appropriate to the nature and scale of the impacts and risks to the environmental values and sensitivities. Given the nature and scale of the petroleum activity, the EMBA is restricted to the operational area.

The Stybarrow Field occurs within BHP-operated Permit Area WA-32-L, located approximately 56 km north-west of Exmouth, Western Australia, in Commonwealth waters. The Stybarrow operational area is located in water depths of approximately 810-850 m. The surrounding area includes Northwest Cape, approximately 25 km south-east of the operational area. Figure 1-1 shows the location of the site and the boundaries of the operational area.

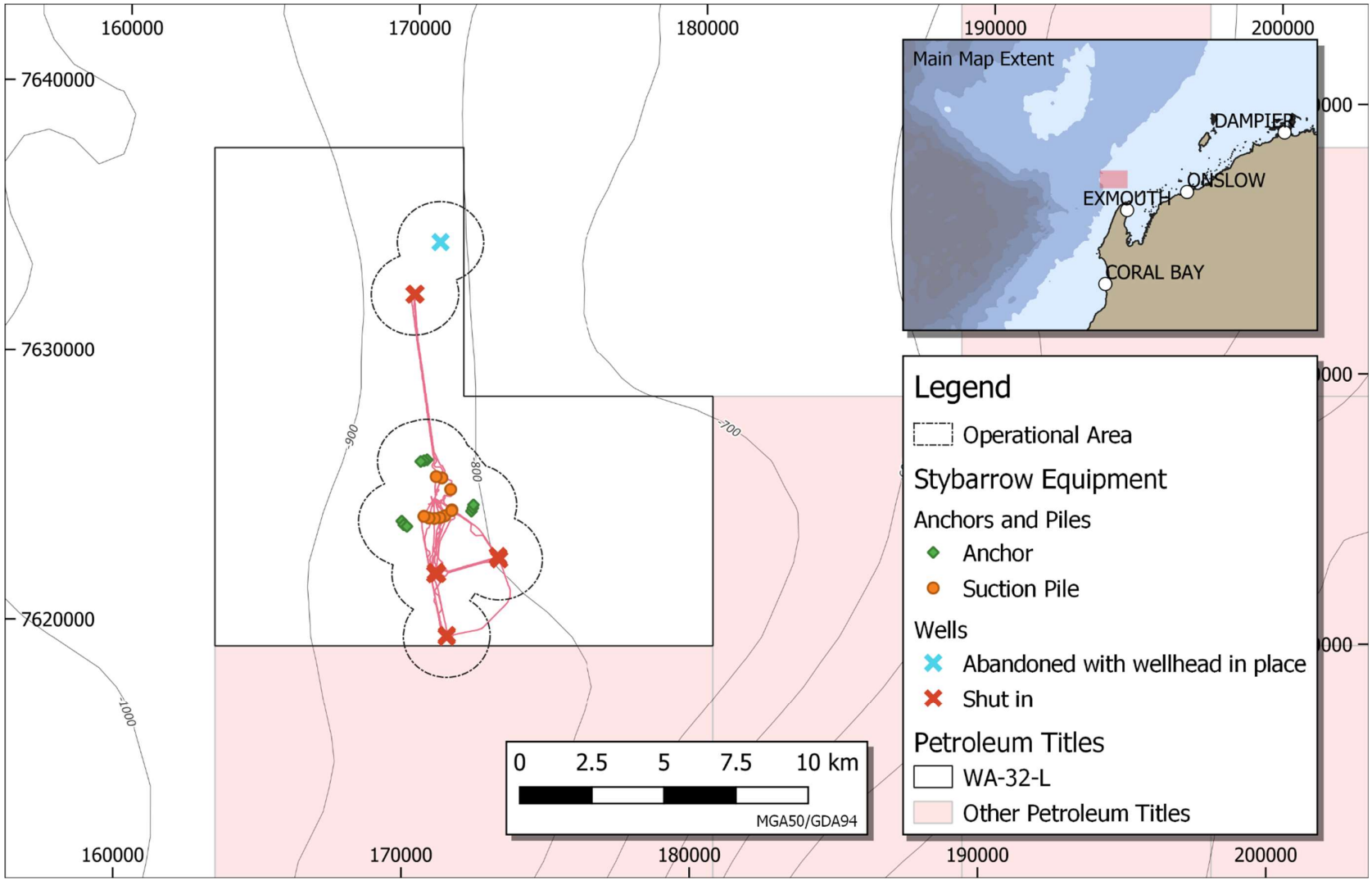

Figure 1-1: Stybarrow end state decommissioning operational area

2 Description of Environment

2.1 Regional Setting

Australia's offshore waters have been divided into six marine regions to facilitate their management by the Australian Government under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). The operational area sits entirely within the North West Province, a provincial-scale bioregion within the North-West Marine Region (NWMR).

The NWMR encompasses Commonwealth waters from the Western Australia (WA)/Northern Territory (NT) border in the north, to Kalbarri in the south (Department of Sustainability, Environment, Water, Population and Communities, 2012). The region's north-western boundary is defined in accordance with the Perth Treaty, negotiated with the Republic of Indonesia, and includes area over which Australia exercises jurisdiction over both the water column and the seabed and its associated resources (Department of the Environment, Water, Heritage and the Arts (DEWHA) 2008).

The NWMR consists entirely of continental slope and is characterised by muddy sediments and water depths that predominantly range between 1000 to 3000 m (DEWHA 2008). The Exmouth Plateau is the dominant topographical feature within the North West Province and is an important feature, as it modifies the flow of deep waters and contributes to uplifting of deeper, more nutrient-rich waters.

The inner shelf component of the North West Province, with water depth ranges from 30 to 60 m, is virtually flat and overlain by sparse sandy substrata. Relict sediments are also present and rhodolith beds of coralline red algae growing on rocks occur between 30 to 90 m (DEWHA 2007). In the deeper waters of the mid shelf (60 to 100 m), sediments comprise sands and gravels on cemented hard grounds. It is reasonably barren substratum with 50% comprising relict reworked material, such as ooid old shoal; hence, there is little recent organic material and the substrata support a generally low biota (DEWHA 2007). The sediments of the outer shelf (100 to 200 m) comprise sands and gravels, transitioning to muds with increasing distance offshore. Detrital rain transports some organic material to the seafloor; however, there is believed to be very few benthic living organisms on this outer shelf (DEWHA 2007).

2.2 Physical Environment

2.2.1 Climate and Meteorology

The operational area experiences an arid sub-tropical climate and a distinct summer monsoonal 'wet' season from November to February, followed by a typically cooler winter 'dry' season (DEWHA 2008). Historical rainfall data shows the highest mean monthly rainfall occurs from January to June (BoM, 2021). The climate is controlled by two major atmospheric pressure systems: Indian Tropical Maritime air moving in from the west or north-west, and tropical continental air from the inland (ANRA, 2013).

The northwest coast between Broome and Exmouth experiences on average about five tropical cyclones between November to April each year (Bureau of Meteorology, n.d.). Cyclones can bring vast amounts of rain to the area, with strong swell and rough seas common during these meteorological events. Most cyclones approach the region from the east-northeast, veering to a southerly track the further south they go (Bureau of Meteorology, n.d.). Observations from the Learmonth weather station are summarised in Table 2-1 and shown in Figure 2-1.

Historical rainfall data indicates the highest rainfall occurs in late autumn/early winter (May to June), while the lowest rainfall occurs in late spring/early summer (October to December).

Table 2-1: Meteorological conditions (for Learmonth) representative of the operational area (Bureau of Meteorology, n.d.)

Month	Mean Maximum Monthly Temperature (ºC)	Mean Minimum Monthly Temperature (ºC)	Mean Rainfall (mm)
January	38.0	23.1	29.1
February	37.5	24.0	39.2
March	36.5	23.0	40.9
April	33.4	20.5	18.1
May	28.6	16.0	41.9
June	24.8	13.1	43.1
July	24.4	11.5	21.5
August	26.5	12.1	11.6
September	29.5	13.8	2.0
October	32.8	16.4	1.5
November	34.6	18.5	1.7
December	36.9	20.9	6.0
Annual Average	**32.0**	**17.7**	**251.5**

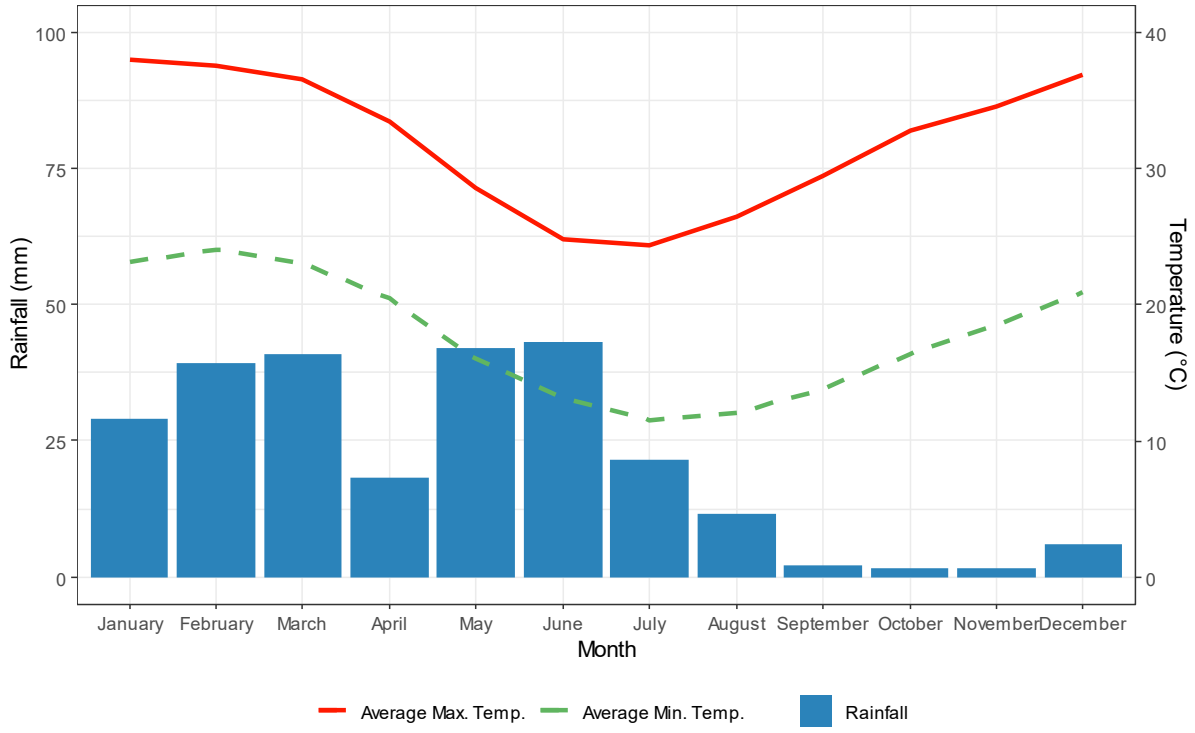

Figure 2-1: Monthly average maximum temperature, minimum temperature, and rainfall from for Learmonth meteorological station (Bureau of Meteorology, n.d.)

Sea surface wind data was sourced from the National Centre for Environmental Predictions' (NCEP) Climate Forecast System Reanalysis. Table 2-2 and Figure 2-2 presents wind data from the nearest NCEP wind station to the Stybarrow operational area. The data indicates winds across the region are relatively strong (average 13.1 knots, maximum 53.4 knots) and varied throughout the year. The

average wind speeds are weakest during April (11.4 knots) and predominantly from the southwest; strongest average winds occur during November (14.9 knots) when they are predominantly from the southwest.

Table 2-2: Predicted average and maximum winds from the closest station to the operational area. Data derived from CFSR hindcast model from 2010-2019 (inclusive) (RPS, 2022)

Month	Average wind (knots)	Maximum wind (knots)	General Direction
January	14.2	53.4	southwest
February	13.2	43.5	southwest
March	12.0	37.5	southwest
April	11.4	49.9	south
May	11.5	40.5	southeast
June	13.0	38.7	southeast
July	13.0	28.3	southeast
August	12.0	30.2	south
September	13.1	29.2	southwest
October	14.5	28.6	southwest
November	14.9	29.1	southwest
December	14.6	31.0	southwest
Minimum	**11.4**	**28.3**	-
Maximum	**14.9**	**53.4**	-
Annual Average	**13.1**	**36.7**	-

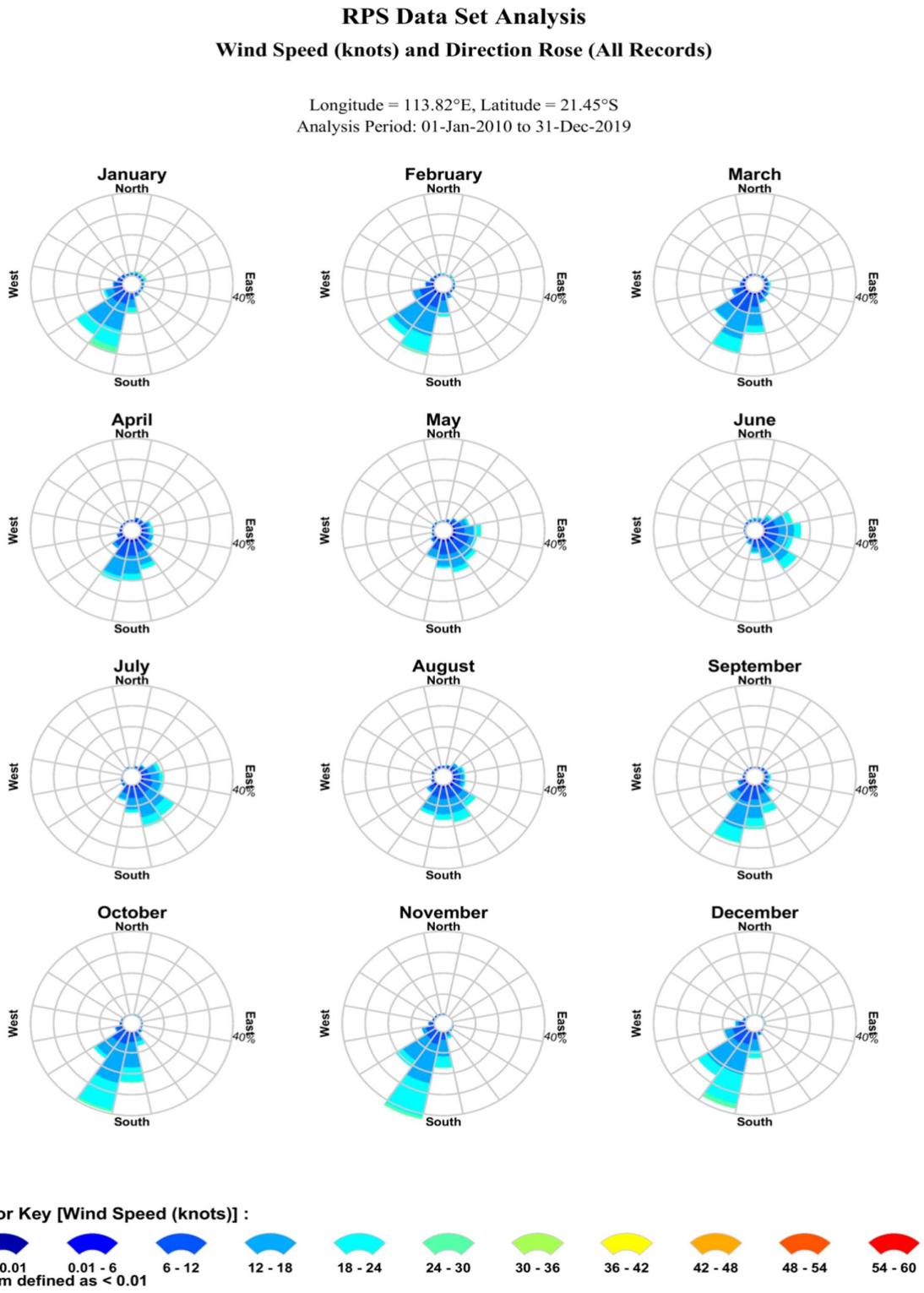

Figure 2-2: Monthly wind roses from the closest station to the operational area (from RPS, 2022)

2.2.2 Oceanography

Currents and Tides

The oceanography within the operational area is strongly influenced by the warm, low-salinity waters of the Indonesian Throughflow (ITF), which influences the upper 1,250 m of the water column (DEWHA 2007). While the origin and movement of shelf waters such as those in the permit area are not well understood, it is believed ITF waters flood the shelf via the Eastern Gyral Current and the Leeuwin Current (Figure 2-3). Surface currents are subject to strong seasonal variations; the Eastern Gyral Current intensifies during July to September and the Leeuwin Current is strongest in autumn and weakens from December to March.

Below the main thermocline, the water column is influenced by Banda Intermediate Water from the north, and Sub-Antarctic Mode Water and Antarctic Intermediate Water from the south (DEWHA 2007). In addition to the major surface and subsurface currents, smaller, localised currents also occur nearshore, such as the Capes, Ningaloo and Shark Bay currents (Figure 2-3). In addition to seasonal variability, the oceanography of the region exhibits inter-annual variability, with winds driving the thermocline to shallower depths, reducing sea level and sea surface temperature, resulting in a weakening of the ITF and Leeuwin Current during El Niño/Southern Oscillation and reversing in La Niña years (DEWHA 2007). There is evidence of a strong northward current between 200 m and 500 m in this area, which may be an offshoot of the eastern gyre (DEWHA, 2007).

Tides in the region are semi-diurnal (there are two high tides and two low tides each day). Spring tides (the highest tidal range each month) are about 1.6 m, while neap tides (the lowest tidal range) are about 0.6 m. The tides run on a northeast and southwest axis and the maximum speed of the tidal streams is about 0.5 m/sec. Wind-driven surface currents reflect the prevailing seasonal wind directions, which are predominantly from the southwest during summer and from the east, southeast and south during winter (Figure 2-2). These prevailing winds generate surface currents of about 0.2 to 0.3 m/sec in the direction of the prevailing wind (Woodside, 2002).

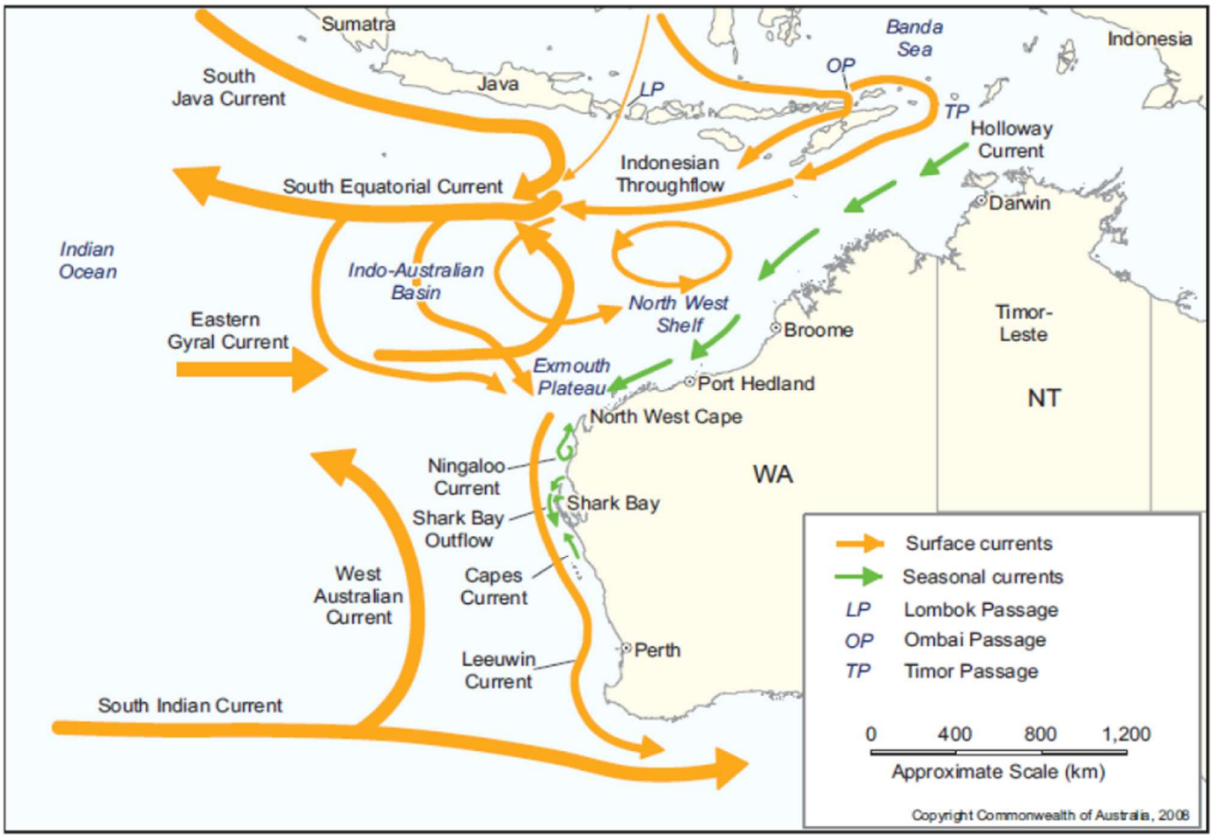

Figure 2-3: Major Ocean Currents Influencing Western Australia (DEWHA 2008)

Waves

The wave regimes in the operational area are caused by the combination of sea waves and swells. Sea waves occur predominantly from the southwest throughout the year, with more easterly waves experienced in winter, while the largest swells generally occur from June to October (Pearce et al., 2003; Woodside, 2002). Therefore, the largest total waves (sea waves combined with swell) occur from June to September, with April and May the calmest months, noting only 10% of significant wave heights off Dampier exceed 1.2 m, with average wave height being 0.7 m (Pearce et al., 2003). However tropical cyclones can generate extreme swells, generally from the northeast.

Water Temperature and Salinity

The average sea surface temperature within the operational area ranges from 22.9 °C (September) to 28.9 °C (March) (RPS, 2022). There is likely to be a distinct thermocline in deep offshore waters, associated with the warming influence of the Leeuwin Current, which overlays colder, more saline, deeper ocean waters that vary seasonally (DEWHA 2008). Salinity is relatively uniform at 35 parts per thousand.

Although the Leeuwin Current is a core movement of the operational area region, it is overall dominated by the ITF. The ITF is one of the primary links in the global exchange of water and heat between ocean basins and is an essential element in the global climate system. It delivers warm, oligotrophic (low in nutrients) and low-salinity water from the western Pacific Ocean to the Indian Ocean, and is a fundamental driver of oceanographic and ecological processes in the region (DEWHA 2008).

Bathymetry and Geomorphology

The Stybarrow Field is located on the physiographic outer shelf/slope within the Northwest Province; the bioregion occurs entirely on the continental slope. This bioregion contains the steepest shelf break of the North-west Marine Region, along the Cape Range Peninsula near Ningaloo Reef.

2.3 Biological Environment

2.3.1 Deep-water Benthic Habitats

Refer to Section 5.3 of the EP.

2.3.2 Pelagic Environments

Plankton

Plankton consists of microscopic organisms typically divided into phytoplankton (algae) and zooplankton (fauna including larvae). Planktons play a major role in the trophic system, with phytoplankton being a primary producer and zooplankton a primary consumer. They are both in turn consumed by other fauna species.

Phytoplankton are autotrophic planktonic organisms living within the photic zone and spend either part or all of their lifecycle drifting with the ocean currents. Phytoplankton depend on oceanographic processes, such as currents and vertical mixing, that supply nutrients needed for photosynthesis. Thus, phytoplankton biomass is typically variable (spatially and temporally) (Evans et al., 2016) but greatest in areas of upwelling, or in shallow waters where nutrient levels are high. Peak primary productivity, however, varies on a local and regional scale.

The trophic system in the pelagic zone of the NWMR is based on phytoplankton (DEWHA, 2008). The distribution of plankton is often associated with localised and seasonal productivity that results in sporadic bursts of phytoplankton and zooplankton communities (DEWHA, 2008). However, in general, the mixing of warm surface water with deeper, more nutrient-rich water generates phytoplankton production and zooplankton blooms.

According to the Australia State of the Environment 2016 Report (Jackson et al., 2017), warming ocean temperatures have extended the distribution of tropical phytoplankton species (which have a lower productivity), further south resulting in a decline in primary productivity in oceanic waters north of 35°, especially the NWS (Evans et al., 2016). However, trends in primary productivity across Australia vary, with the southwest of Australia experiencing an increase in productivity and northern Australia experiencing no change between 2002 to 2016 (Evans et al., 2016).

Cyclones can influence the distribution and abundance of plankton. Observations of Cyclone Tiffany, which affected the NWS in January 1988, noted that communities of phytoplankton rapidly recovered as a result of changed nutrient conditions, while zooplankton species were transported into areas beyond their normal range due to changes in current, wind and wave patterns (DEHWA, 2008).

Fish

Some 1,400 species of finfish are known to occur in the region, mostly of a tropical Indo-West Pacific affinity, with a greater proportion occurring in shallow coastal waters (DEWHA, 2008). In general, most fish in the region are associated with coral reefs. For example, the abundance, species richness and assemblage structure of juvenile fishes was quantified in 2009 to 2011 at 20 locations extending from Bundegi to 3-Mile Camp and covering around 280 km of the Ningaloo coastline. Sampling included back reef and lagoonal reef zones as well as sanctuary and recreational management zones. In total, 36,791 juvenile fishes from 120 species were observed over the three recruitment years, providing an average of 53 individuals (± 2.6 standard error) per 30 m^2 transect.

Interestingly, recruitment rates varied significantly among sampling times (in other words, temporal variation). Transect abundance means ranged from 82 ± 6.3 individuals (2009), 19 ± 1.2 individuals (2010) to 77 ± 4.6 individuals (Depczynski et al., 2011). The authors of this study noted the 75% drop in abundance in 2010 coincided with a small increase in mean species richness. Different pelagic fish occur in the deeper offshore waters of the region. Pelagic fish species are seasonally abundant and may pass through the area during annual migrations. The most notable species of deep-water pelagic fishes in the area are the billfish, which include sailfish, marlin (both family Istiophoridae) and swordfish (*Xiphias gladius*).

The region also supports diverse and abundant shark and ray populations. Whaler sharks (Family Carcharhinidae) are the most numerous and diverse, occurring in a wide range of habitats such as intertidal (black-tip reef shark – *Carcharhinus melanopterus*), offshore reefs (grey reef shark – *C. amblyrhynchos*) and deep ocean areas (oceanic white-tip shark – *C. longimanus*).

2.4 Matters of National Significance

Conservation values and sensitivities listed and protected under the EPBC Act include matters of environmental significance (MNES) and other protected matters. Other internationally significant conservation values have been identified via the World Database on Protected Areas and UNESCO data sources.

Table 5.1 of the EP summarises the MNES identified as potentially occurring within the operational area, as determined by the EPBC Protected Matters search results included in this Attachment 1 of this Appendix.

2.4.1 Commonwealth and International Marine Areas

The operational area is within Australia's exclusive economic zone (EEZ) and Territorial Sea. All of this area Commonwealth marine area which are defined any part of the sea, including the waters, seabed and airspace, within Australia's EEZ or over the continental shelf of Australia, that is not State or NT waters. The Australian Commonwealth marine area stretches from 3 to 200 nm from the coast.

2.4.2 World Heritage Properties

There are no World Heritage Properties within the operational area.

2.4.3 National Heritage Properties

There are no National Heritage Properties within the operational area.

2.4.4 Commonwealth Heritage Places

There are no Commonwealth Heritage Properties within the operational area.

2.4.5 Wetlands of International Importance

There are no Wetlands of International Importance within the operational area.

2.4.6 Wetlands of National Importance

There are no Wetlands of National Importance within the operational area.

2.4.7 Threatened Ecological Communities

There are no Threatened Ecological Communities within the operational area.

2.4.8 Protected Species

The EPBC Act PMST was used to identify listed threatened and migratory species that may occur within the operational area (refer to Table 5-2 in EP). The PMST results identified 20 marine fauna species listed as `threatened' species and 31 marine fauna species listed as `migratory' within the operational area. Descriptions of the threatened and migratory species are provided in this section. The PMST report is provided as Attachment 1of this Appendix.

Listed Species Recovery Plans, Conservation Advice and Threat Abatement Plans

Refer to Section 9 of the EP for consideration of species recovery plans, conservation advice and threat abatement plans relevant to the petroleum activity.

Biologically Important Areas and Habitat Critical to the Survival of a Species

Refer to Section 5.5.2 of the EP for consideration of Biologically Important Areas and Habitats Critical to the Survival of a Species in relation to the petroleum activity.

Summary of Windows of Ecological Sensitivity

Table 2-3 summarises the windows of ecological sensitivity for values identified within the operational area. These receptors are considered throughout the Environment Plan in terms of the identified potential risk.

Table 2-3: Key Environmental Sensitivities and Timing of Biologically Important Activity

Category	Environmental Sensitivity	Location	Season
Marine mammals	Humpback – migration	The migration corridor extends from the coast to out to around 100 km offshore in the Kimberley region extending south to North-west Cape	Northern migration, late July to September
	Pygmy blue whale – migration	WA coastline	Northern migration (enter Perth canyon January to May; pass Exmouth April to August) Southern migration (October to late December)
	Pygmy blue whale – foraging	Ningaloo	November to May
Marine reptiles	Flatback turtle – internesting	Thevenard Island (South), Montebello Islands (Hermite Island	Summer
Sharks/fish	Whale shark – foraging	Northwards of Ningaloo	Spring
	Whale shark – foraging	Ningaloo Marine park and adjacent Commonwealth waters	April to June, Autumn

Category	Environmental Sensitivity	Location	Season
Birds	Wedge-tailed shearwater – breeding	Kimberley, Pilbara and Gascoyne coasts and islands including Ashmore Reef	Breeding visitor arriving in mid-August and leaving in April in Pilbara and mid-May in Shark Bay

2.5 Marine Mammals

A search of the EPBC Protected Matters database identified 10 protected marine mammal species with potential to occur within the operational area.

2.5.1 Threatened and Migratory Species

Antarctic Minke Whale

The Antarctic minke whale (*Balaenoptera bonaerensis*) is listed as migratory under the EPBC Act. This large baleen whale swims alone or in pairs; numbers are not well documented. The distribution of this species in WA is unknown; however, they are known to occur offshore within cold temperate to Antarctic waters (DAWE, 2021). The species migrates between Antarctic feeding grounds to warmer tropical and subtropical waters and calving occurs in warmer waters during late May and early June after winter migration from Antarctic waters.

According to the PMST report, Antarctic minke whales were identified as likely to occur or have habitat within the operational area.

Sei Whale

Sei whales (*Balaenoptera borealis*) are listed as vulnerable and migratory under the EPBC Act. Sei whales are not commonly recorded in Australian waters and their similarity to Bryde's whales has resulted in confusion about their distributional limits and the accuracy of recorded observations (DoE, 2020a). There are no known mating or calving areas in Australian waters. The species migrates between Australian waters and Antarctic feeding areas but their movements are unpredictable and not well documented. They have been sighted inshore (in the proximity of the Bonney upwelling in Victoria) as well as in deeper offshore waters, and have only been sighted in summer and autumn (DAWE, 2021).

According to the PMST report, sei whales are likely to occur or have habitat within the operational area; however, due to infrequent sighting in Australia, the likelihood of these whales being present is very low.

Bryde's Whale

Bryde's whale (*Balaenoptera edeni*) is listed as migratory under the EPBC Act. It is considered the least migratory of the whale species in Australian waters and is typically found in tropical waters between 40°S and 40°N year-round (Bannister et al., 1996; DAWE, 2020). The species frequents oceanic waters as well as nearshore areas following zones of upwelling around the continental shelf (Mustoe and Edmunds, 2008).

According to the PMST report, Bryde's whales were identified as likely to occur or have habitat within the operational area.

Blue Whale

Blue whales (*Balaenoptera musculus*) are listed as endangered and migratory under the EPBC Act. There are two recognised subspecies of blue whale in the southern hemisphere that are both recorded in Australian waters, the southern (or 'true') blue whale (*Balaenoptera musculus intermedia*) and the 'pygmy' blue whale (*Balaenoptera musculus brevicauda*). In general, southern blue whales occur in waters south of 60°S and pygmy blue whales occur in waters north of 55°S (not in the Antarctic). By this definition, all blue whales in waters from Kalbarri to the NT border are assumed to be pygmy blue whales and are discussed below.

Pygmy blue whales have a southern hemisphere distribution, migrating from tropical water breeding grounds in winter to temperate and polar water feeding grounds in summer (Bannister et al., 1996;

Double et al., 2014). Passive acoustic data documented pygmy blue whales migrating along the WA shelf break at depths of 500 to 1000 m (McCauley & Jenner, 2010).

During the southern migration, pygmy blue whales pass south of the Montebello Islands and Exmouth from October to the end of January, peaking in late November to early December (Double et al., 2012). On the return journey, tagging surveys have shown pygmy blue whales migrating northward relatively near to the Australian coastline (100 km) until reaching North West Cape, after which they travelled offshore (240 km) to Indonesia. Blue whales have been detected off Exmouth and the Montebello Islands between April and August (Double et al., 2012; McCauley & Jenner, 2010) (Figure 2-4).

According to the PMST report, pygmy blue whales were identified as using the operational area for migration purposes. Considering the known usage of the area for migration, it is likely the pygmy blue whale will be regionally present, particularly over the summer season between April and August (north-bound migration) and October to January (south-bound migration).

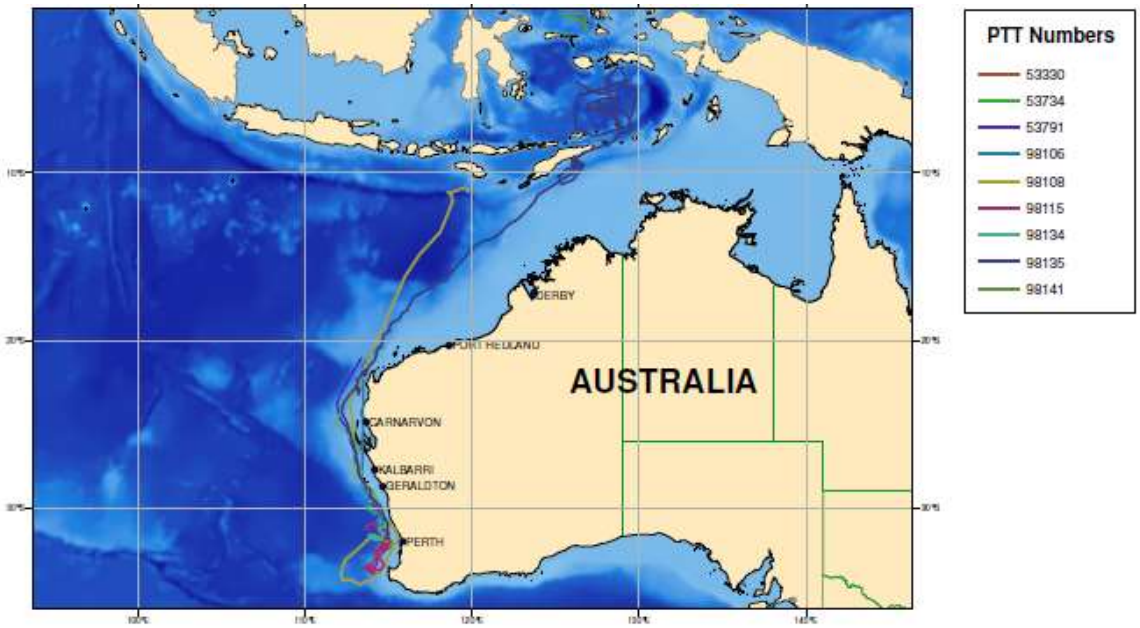

Figure 2-4: Satellite Tracking of Blue Whales in 2010/2011, Modified from Double et al. (2012)

Fin Whale

The fin whale (*Balaenoptera physalus*) is listed as vulnerable and migratory under the EPBC Act. It is the second-largest whale species after the blue whale. Fin whale distribution in Australian waters is known primarily from stranding events and whaling records. Due to scarcity of sighting records, the distribution cannot be accurately determined, although it is thought to be along the western coast of Australia, southern Australia around to Tasmania. The Australian Antarctic waters are important feeding grounds but there are no known mating or calving areas in Australian waters (Morrice et al., 2004). The migration routes and location of winter breeding grounds are uncertain, but presence in Australian waters has been detected in summer and autumn months (DoEE, 2017).

According to the PMST report, Fin whales were identified as likely to occur or have habitat in the operational area; however, due to infrequent sightings in Australia, the likelihood of these whales being present is low.

Southern Right Whale

The southern right whale (*Eubalaena australis*) is listed as endangered and migratory under the EPBC Act. The species is seasonally present on the Australian coast between May and November and recorded in the coastal waters of all Australian states (Bannister et al., 1996). Major calving areas are located in WA at Doubtful Island Bay, east of Israelite Bay in the southwest; and in South Australia at Head of Bight (Bannister et al., 1996). The distribution of southern right whales in Australian waters other than near the coast is unknown and very little information is known about the migratory patterns, habitats, calving areas or feeding habits, but peak periods for mating are known to be from mid-July through to August (DAWE, 2020).

Isolated individuals have been seen outside the normal season but a summer sighting would be very unusual. Australian southern right whales migrate seasonally between higher and middle latitudes. The general timing of migratory arrivals and departures varies slightly each year. Migratory pathways are not well known (Bannister et al., 1996). A circular, anticlockwise migration pattern south of the Australian continent was proposed by Hart et al. (1842), based on the seasonal location of whaling activity. This generalised migratory pattern is further supported by most inter-year coastal movements, being in a westerly direction, and between-year coastal movements, being in an easterly direction (Burnell, 2001).

According to the PMST report, the southern right whale and its habitat may occur within the operational area.

Humpback Whale

The humpback whale (*Megaptera novaengliae*) is listed as migratory under the EPBC Act. Humpback whales occur throughout Australian waters, their distribution being influenced by their migratory pathways and aggregation areas for resting, breeding and calving. In the southern hemisphere, humpback whale populations spend the summer months feeding in the Antarctic polar region before migrating north to tropical breeding/calving grounds in the coastal waters of the Kimberley.

Aerial surveys and noise logger recordings for Chevron's Wheatstone Project show most distributions of humpback whales were sighted at an average distance of 50 km from the mainland during the northern migration and 35 km during the southbound migration (RPS, 2010). The southbound migration moves down the coast between late August and November, although females with calves have been documented leaving the calving areas last, with a later peak in abundance observed from mid-August to mid-September (Jenner et al., 2001).

Humpback whales were identified as likely to occur or have habitat in the operational area.

According to the PMST report, the humpback whale and its habitat is likely to occur within the operational area. Considering the likely utilisation of the waters as feeding ground, this assessment is believed to be accurate.

Killer Whale (Orca)

The orca (*Orcinus orca*) is listed as migratory under the EPBC Act and is the largest member of the dolphin family. Orcas are found in both tropical and temperate waters in oceanic, pelagic and neritic waters (DAWE, 2020). Orcas usually travel in groups of ten to 30 individuals and make seasonal migrations, and may follow regular migratory pathways; however, this has not been proven. No specific information about migratory pathways along the WA coast is documented. Orcas have been recorded relocating to Antarctic waters during summer months and back to warmer waters during winter. This suggests that during the winter months would be the highest likelihood of occurrence of orcas on the NWS.

According to the PMST report, the orca has been identified as may occur or have habitat within the operational area.

Sperm Whale

The sperm whale (*Physeter macrocephalus*) is listed as migratory under the EPBC Act. It has a wide distribution extending from the polar regions to the equator, although it is usually found in deeper oceanic waters near continental breaks and canyons (DAWE, 2020). Females and young males tend to remain in warmer waters, whereas adult males venture further away from the equator to colder waters. Limited information exists about sperm whale distribution in Australian waters.

According to the PMST report, Sperm whales have been identified as may occur or have habitat within the operational area.

Spotted Bottlenose Dolphin

The spotted bottlenose dolphin (Arafura/Timor Sea population) (*Tursiops aduncus*) is listed as migratory under the EPBC Act. Occurring Australia-wide, this species resembles the common bottlenose dolphin. This species prefers shallower inshore bays and estuaries and travels in groups consisting on average of between five and 16 individuals (DAWE, 2020). Migratory movements in Australia vary and are likely to be triggered by baitfish movements. This species can spend all year in one location but can also make long-range movements.

According to the PMST report, the spotted bottlenose dolphin was identified as may occur or have habitat within the operational area. As the species prefers shallower, inshore waters they are most likely to occur within the coastal waters and not in the operational area or deeper waters.

2.6 Marine Reptiles

A search of the EPBC Protected Matters database identified five protected reptile species within the operational area.

2.6.1 Threatened and Migratory Species

Loggerhead Turtle

The loggerhead turtle (*Caretta caretta*) is listed as endangered and migratory under the EPBC Act. It has a worldwide distribution, living and breeding in subtropical to tropical locations (Limpus, 2008a). The annual nesting population in WA is thought to be 3000 females annually (Baldwin et al., 2003), and this is considered to support the third largest population in the world (Limpus, 2008a).

Nesting and breeding occurs from October to March, with a peak in late December/early January (DoEE, 2017). Major nesting beaches include the Muiron Islands, Ningaloo Coast south to Carnarvon.

Foraging areas are widespread for loggerhead turtle populations and migrations from nesting to feeding grounds can stretch thousands of kilometres, including feeding grounds as far north as the Java Sea of Indonesia for the WA population (Limpus, 2008a). Loggerhead turtles are carnivorous and feed primarily on benthic invertebrates from depths ranging from around 50 m to nearshore tidal areas (DAWE, 2020), including areas of rocky and coral reef, muddy bays, sand flats, estuaries and seagrass meadows (Limpus, 2008a).

According to the PMST report, the loggerhead turtle or its habitat is known to occur within the operational area.

Green Turtle

The green turtle (*Chelonia mydas*) is listed as vulnerable and migratory under the EPBC Act. It has a worldwide tropical and subtropical distribution and is widespread and abundant in WA waters, with an estimated 20,000 individuals occurring in WA, arguably the largest population in the Indian Ocean (Limpus, 2008b). The principal rookeries in WA include the Lacepede Islands, Barrow Island, Montebello Islands (all sandy beaches), Muiron Islands, Browse Island, Northwest Cape, and Ningaloo Coast North. Nesting occurs between November and March, with the peak period between January and March.

Green turtles are omnivores, mainly feeding in shallow benthic habitats on seagrass or algae, but are also known to feed on sponges, jellyfish and mangroves (Limpus, 2008b). Green turtles are unlikely to forage or dwell within deeper offshore waters due to the water depths; however, they may occasionally migrate through it.

According to the PMST report, the green turtle or its habitat is known to occur within the operational area. No BIAs for the species lie within the operational area.

Leatherback Turtle

The leatherback turtle (*Dermochelys coriacea*) is listed as endangered and migratory under the EPBC Act. It has the widest distribution of any marine turtle and can be found from tropical to temperate waters throughout the world (Márquez, 1990). There are no major centres of nesting activity that have been recorded in Australia, although scattered isolated nesting (one to three nests per annum) occurs in southern Queensland and the NT (Limpus & McLachlin, 1994). There have been several records of leatherback turtles off the coast of WA but no confirmed nesting sites (Limpus, 2009).

According to the PMST report, the leatherback turtle was identified as known to occur or have habitat within the operational area.

Hawksbill Turtle

The hawksbill turtle (*Eretmochelys imbricata*) is listed as vulnerable and migratory under the EPBC Act. Hawksbill turtles have a global distribution throughout tropical and subtropical marine waters. The WA stock is concentrated on the NWS, one of the largest hawksbill populations in the world. The most significant breeding areas are around the sandy beaches of the Dampier Archipelago and the Montebello Islands. Hawksbill turtles also nest at North West Cape/Ningaloo Coast, Muiron Islands, Varanus Island, the Lowendal Islands and Rosemary Island. Nesting occurs throughout the year in WA, peaking between October and January.

Adults tend to forage in tropical tidal and subtidal coral and rocky reef habitat where they feed on an omnivorous diet of sponges, algae, jellyfish and cephalopods (DAWE, 2020).

According to the PMST report, the hawksbill turtle was identified as known to occur or have habitat within the operational area. No BIAs for the species lie within the operational area. No habitat critical to the survival of the species lie within the operational area. Considering the water depth of the operational area, it is unlikely hawksbill turtles forage in the area but may migrate through it.

Flatback Turtle

The flatback turtle (*Natator depressus*) is listed as vulnerable and migratory under the EPBC Act. It has an Australasian distribution, with all recorded nesting beaches occurring within tropical to subtropical Australian waters (Limpus, 2007). They are known to feed on mid-water plankton and benthic organisms and can forage in mid-shelf water depths (up to about 50 m). Breeding and nesting is restricted to northern WA (Limpus, 2007). The Pilbara genetic stock of flatback turtles is concentrated on islands of the Pilbara coastal change, Barrow Island and Dampier Archipelago (DAWE, 2017). Significant rookeries are centred on Barrow Island, especially the east coast beaches (DoEE, 2017). While inter-nesting flatback turtles can travel up to 62 km away from their rookery between nesting events, these movements were in a longshore direction and individuals were restricted to shallow water depths (Whittock et al., 2014).

Unlike other sea turtles, the flatback turtle lacks a wide oceanic dispersal phase and adults tend to be found in soft sediment habitats within the continental shelf of northern Australia (DAWE, 2020).

According to the PMST report, the flatback turtle was identified as known to congregate within the operational area. No BIAs for the species lie within the operational area.

2.7 Fish, Sharks and Rays

A search of the EPBC Protected Matters database identified five protected species and two conservation-dependent species that occur within the operational area.

2.7.1 Threatened and Migratory Species

Oceanic Whitetip Shark

The oceanic whitetip shark is listed as a migratory species under the EPBC Act. The oceanic whitetip shark is a widespread pelagic species that has been subject to overfishing throughout much of its distribution. The oceanic whitetip shark is widespread throughout tropical and subtropical pelagic waters of the world (30°N to 35°S). Within Australian waters, it is found from Cape Leeuwin (WA) through parts of the NT, down the east coast of Queensland and NSW to Sydney (DAWE, 2021b).

According to the PMST report, the oceanic whitetip shark was identified as may occur or have habitat within the operational area.

Grey Nurse Shark

The grey nurse shark (*Carcharias taurus*, west coast population) is listed as vulnerable under the EPBC Act. Globally, the species is listed as vulnerable in the International Union for Conservation of Nature (IUCN) Red List of Threatened Species. Grey nurse sharks are now restricted to two populations, one on the east coast from southern Queensland to southern NSW and the other around the southwest coast of WA. The grey nurse shark is now considered extinct in Victorian waters. It is believed the east and west coast populations do not interact. The west coast population has a broad inshore distribution, primarily in subtropical to cool temperate waters (Last and Stevens, 2009). The population of grey nurse sharks (west coast population) is predominantly found in the southwest coastal waters of WA (DoE, 2014) and has been recorded as far north as the NWS (Stevens, 1999; Pogonoski et al., 2002).

Adult grey nurse sharks feed on a wide range of fish, other sharks, squid, crabs and lobsters, and the greatest threat to grey nurse sharks is considered to be incidental bycatch in commercial fisheries.

Individuals are thought to have a high degree of site fidelity, although some studies have suggested the species exhibits some migratory characteristics, moving between different habitats and localities (McCauley, 2004). The high endemism of the species ensures the grey nurse shark is vulnerable to localised pressures in certain areas. The status of the west coast population is poorly understood,

although it is reported to remain widely distributed along the WA coast and individuals are regularly encountered, albeit with low and indeterminate frequency (Chidlow et al., 2006).

Grey nurse sharks are frequently observed hovering motionless just above the seabed in or near deep sandy-bottomed gutters or rocky caves, and in the vicinity of inshore rocky reefs and islands (Pollard et al., 1996). The species has been recorded at varying depths but is generally found between 15 to 40 m (Otway and Parker, 2000). Grey nurse sharks have also been recorded in the surf zone, around coral reefs, and to depths of around 200 m on the continental shelf (Pollard et al., 1996).

According to the PMST report, the grey nurse shark may occur or have habitat within the operational area, however the species is unlikely to be present due to the water depth being substantially deeper than their preferred habitat.

White Shark

The white shark (*Carcharodon carcharias*) is listed as vulnerable and migratory under the EPBC Act. It occurs in almost all coastal and offshore waters of the major oceans that have water temperature between 12 and 24°C with greater concentrations in the United States of America (Atlantic Northeast and California), South Africa, Japan, Australia/Oceania, Chile and the Mediterranean. In Australian waters, they are widely but not evenly distributed and sightings are considered uncommon to rare compared to most other large sharks. Great white sharks can be found in areas close inshore around rocky reefs, surf beaches and shallow coastal bays, and as far out as the outer continental shelf and slope areas (Pogonoski et al., 2002).

This shark reaches its maturity around 15 years of age and can have a life span of more than 30 years. White sharks are known to prey on marine mammals and various other marine animals, including fish and seabirds, and have been frequently recorded in WA, particularly during humpback whale migrations.

According to the PMST report, the white shark may occur or have habitat within the operational area.

Shortfin Mako

The shortfin mako shark (*Isurus oxyrinchus*) is listed as a migratory species under the EPBC Act. It is a coastal, oceanic species occurring from the surface to at least 500 m depth and is widespread in temperate and tropical waters of all oceans, from about 50°N (up to 60°N in the northeast Atlantic) to 50°S. It is occasionally found close inshore where the continental shelf is narrow.

According to the PMST report, the shortfin mako shark is likely to occur or have habitat within the operational area.

Longfin Mako

The longfin mako (*Isurus paucus*) is listed as a migratory species under the EPBC Act. It is a widely distributed but rarely encountered oceanic shark. This species is known to be caught as bycatch in tropical pelagic longline fisheries for tuna, swordfish and sharks and in other oceanic fisheries. This species appears to be cosmopolitan in tropical and warm temperate waters. However, present records are sporadic and the complete distribution remains unclear.

According to the PMST report, the longfin mako shark is likely to occur or have habitat within the operational area.

Giant Manta Ray

The giant manta ray (*Manta birostris*) is listed as a migratory species under the EPBC Act and is the largest of the rays. The species has a tropical and semi-temperate distribution worldwide that includes WA. The giant manta ray appears to be a seasonal visitor to coastal sites and satellite tracking studies have revealed it to be capable of migrations of more than 1000 km in distance. The migratory pattern in WA is not well documented however giant manta rays have been recorded in abundance off Ningaloo Reef (Sleeman et, al, 2007)

According to the PMST report, the giant manta ray is likely to occur or have habitat within the operational area.

2.7.2 Conservation-Dependent Species

Scalloped Hammerhead Shark

The scalloped hammerhead shark (*Sphyrna lewini*) is classified as critically endangered on the IUCN Red List of Threatened Species (last assessed November 2018) and was listed as a conservation-dependent species on 15 March 2018 in the EPBC Act. There is no adopted or made recovery plan for this species. The following information is sourced from the Commonwealth Listing Advice (TSSC, 2018).

The scalloped hammerhead is a coastal and semi-oceanic shark. Pups are born in shallow intertidal habitats where they remain in shallow inshore habitats for the first few years. Information collected from deeper water fisheries (but still on the continental shelf) suggests juveniles and some adults, particularly males, remain in coastal waters, while some mature adults may move into deeper pelagic waters.

The principal threat to the species is fishing activity. The species has a circum-global distribution in tropical and subtropical waters and the Australian stock is likely to be shared with Indonesia and possibly a broader Indo-Pacific population. Within Australian waters, scalloped hammerheads are found across northern and temperate Australian waters, extending from NSW, around the north of the continent and then south into WA, to around Geographe Bay (see Figure 2-5). The distribution of the species in WA is sparse. They have been recorded in WA in the catch of the Pilbara Fish Trawl Fishery.

It is possible scalloped hammerheads are in the operational area.

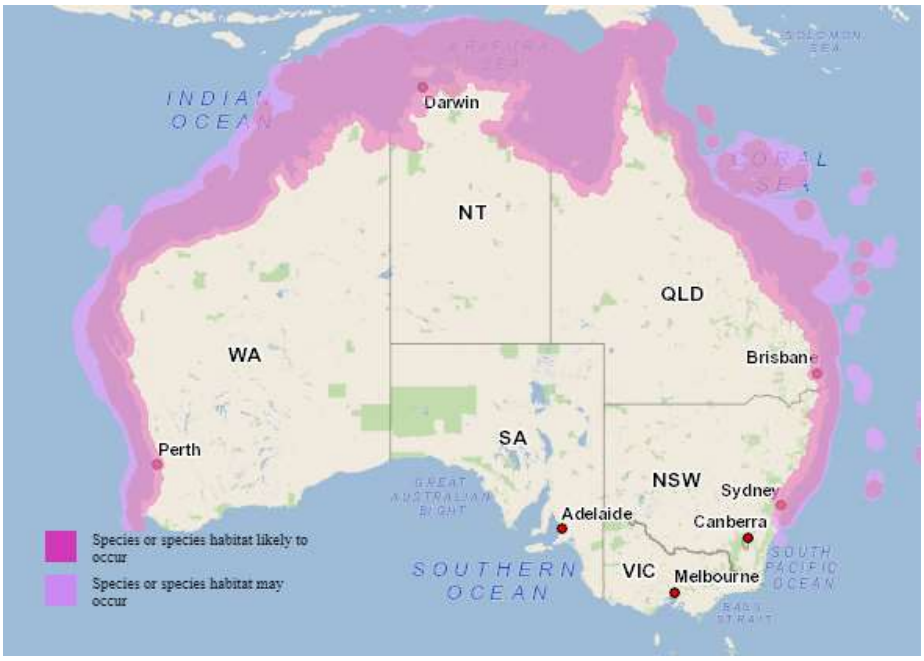

Figure 2-5: Distribution Map of Scallop Hammerhead Sharks (Geosciences Australia, 2014)

Southern Bluefin Tuna

The southern bluefin tuna (*Thunnus maccoyii*) is classified as critically endangered on the IUCN Red List of Threatened Species (last assessed January 2021) and was listed as a conservation-dependent species on 15 December 2010 in the EPBC Act. There is no adopted or made recovery plan for this species. The following information is sourced from the Commonwealth Listing Advice (TSSC, 2010).

The southern bluefin tuna is a highly migratory species that occurs globally in waters between 30°S and 50°S, though is mainly found in the eastern Indian Ocean and in the south Western Pacific Ocean. In Australian waters, the southern bluefin tuna ranges from northern WA, around the southern region of the continent, to northern NSW (see Figure 2-6). The southernmost portion of the spawning ground lies within Australia's EEZ.

It is possible southern bluefin tuna are in the operational area.

Figure 2-6: Distribution Map of Southern Bluefin Tuna (Geosciences Australia, 2014)

2.8 Seabirds and Migratory Shorebirds

A search of the EPBC Protected Matters database identified 14 EPBC-protected bird species listed within the operational area.

2.8.1 Threatened and Migratory Species

Seabirds

Common Noddy

The common noddy (*Anous stolidus*) is listed as migratory under the EPBC Act. Four sub-species of the common noddy are recognised, but only the sub-species *Anous stolidus pileatus* occurs in the Australian region. It occurs mainly off the Queensland coast, but also off the northwest and central WA coast.

The migratory movements of the species are poorly known. The common noddy is a gregarious bird, normally occurring in flocks, sometimes of hundreds of individuals, when feeding or roosting. They feed mainly on fish, but are also known to take squid, pelagic molluscs and aquatic insects by dipping or skimming the sea surface. The species usually feeds during the day but will also feed at night when there is a full moon. Timing of breeding varies between sites and may be annual or twice a year. On some islands, the species is known to breed throughout the year. It is known to disperse to the open ocean after breeding (DoEE, 2017).

According to the PMST report, the common noddy may occur or have habitat within the operational area.

Australian Fairy Tern

The Australian fairy tern (*Sternula nereis nereis*) is listed as vulnerable under the EPBC Act and has been identified as a conservation value in the NWMR. Breeding occurs between October to February on continental islands, coral cays, on sandy islands and beaches inside estuaries, and on open sandy beaches (DAWE, 2020). The species feeds predominantly on small fish in shallow waters (DSEWPC, 2011d).

The main threat to the subspecies is the disturbance of breeding sites by human activities and predation by introduced species and birds.

According to the PMST report, the Australian fairy tern was identified as likely to forage within the operational area.

Christmas Island White-Tailed Tropicbird

The Christmas Island white-tailed tropicbird (*Phaethon lepturus fulvus*) is listed as endangered under the EPBC Act. It is endemic to Christmas Island, which is its only known breeding location. It is widely distributed across the island (Director of National Parks, 2014) and roosts and forages over the Indian Ocean. Both adults and juveniles appear to disperse widely and have been recorded south and southeast of Christmas Island (Marchant and Higgins, 1990). The subspecies mostly occurs north of 18°S but may occur up to about 1500 km from Christmas Island, at the edge of the continental shelf off Western Australia at 21°S (Dunlop et al., 2001).

According to the PMST report, the Christmas Island white-tailed tropicbird may occur or have habitat within the operational area. The edge of the operational area is approximately 1500km from Christmas Island so the species may forage on the fringes of the operational area.

White-Tailed Tropicbird

The white-tailed tropicbird (*Phaethon lepturus*) is listed as migratory under the EPBC Act. It is found in the tropical Atlantic, western Pacific and Indian Oceans. The white-tailed tropicbird breeds on tropical islands (such as some Caribbean Islands and Bermuda), laying a single egg directly onto the ground or a cliff ledge. It disperses widely across the oceans when not breeding, and sometimes wanders far. The white-tailed tropicbird does not have a yearly breeding cycle; instead, breeding frequency depends on the climate and availability of suitable breeding sites.

According to the PMST report, the white-tailed tropicbird may occur or have habitat within the operational area. The operational are is not near white-tailed tropicbird breeding areas so the species may transit the area for migrating and foraging.

Indian Yellow-Nosed Albatross

The Indian Yellow-nosed Albatross (*Thalassarche carteri*) is listed as vulnerable and migratory under the EPBC Act. The Indian Yellow-nosed Albatross forages mostly in the southern Indian Ocean and is abundant off Western Australia (Marchant & Higgins 1990). In waters off southern Western Australia and South Australia the species is most abundant between March and May.

According to the PMST report, the Indian Yellow-nosed Albatross may occur or have habitat within the operational area.

Lesser Frigatebird

The lesser frigatebird (*Fregata ariel*) is listed as a migratory species under the EPBC Act and is found widespread throughout the northern reaches of Australia, from around Geraldton on the west coast throughout the north to the east coast. The species is found throughout most shorelines. The species is the smallest frigatebird and is well adapted for an aerial existence and may range significant distances from land. This seabird is found in tropical waters of the Indian Ocean and breeds on small, remote tropical and subtropical islands in mangroves or bushes, and even on bare ground. It feeds on fish, cephalopods, seabird eggs and chicks, carrion and fish scraps. Little information is available about the migratory movements of this species. Breeding appears to occur between May and December in Australia. Outside the breeding season, the species is sedentary.

According to the PMST report, the lesser frigatebird may occur or have habitat within the operational area.

Southern Giant Petrel

The southern giant petrel (*Macronectes giganteus*) is listed as endangered and migratory under the EPBC Act. It is the largest of the petrels and occurs from Antarctic to subtropical waters. The petrel spends most of the warmer months of the year in the southern extents of its distribution range while breeding, before leaving for warmer waters during winter, including the southern portion of the NWS for foraging. The southern giant petrel is both an opportunistic scavenger of carrion and a predator, with prey items ranging from surface marine life (including krill) to smaller seabirds (DoEE, 2017). The southern giant petrel breeds once a year between August and September, returning from foraging locations to breeding grounds in Antarctic waters.

According to the PMST report, the southern giant petrel may occur or have habitat within the operational area however they it is likely these would be in small numbers.

Common Sandpiper

The common sandpiper (*Actitis hypoleucos*) is listed as a migratory species under the EPBC Act, breeding in eastern Europe before migrating to spend its non-breeding season in Australia. In

Australia, it can be found singularly or in small groups along all coastlines and many inland areas. The species inhabits a wide range of coastal wetlands and is most often found around the muddy margins, mangroves and rocky shores. Their diet consists of bivalves, crustaceans and a variety of insects and are mostly found in coastal and inland locations. The species is very widespread, and habitats can occur all over Australia, both coastal and inland.

According to the PMST report, the common sandpiper may occur or have habitat within the operational area.

Curlew Sandpiper

The curlew sandpiper (*Calidris ferruginea*) is a listed as a critically endangered and migratory shorebird under the EPBC Act. A small, slender, gregarious sandpiper that is found along the coastlines and inland waters of Australia. In WA, the species occurs extensively between Cape Arid to the Kimberley region (DoEE, 2017). It is most common on sheltered intertidal mudflats, roosts on dry beaches, spits and islets, and breeds only in Siberia. It leaves breeding grounds in July and August, arriving in Australia in late August and early September (Higgins and Davies, 1996). Flocks stop in northern Australia before moving on to south-eastern Australia. Most birds arrive in September. Return migration commences in March (DoEE, 2017).

According to the PMST report, this species may occur or have habitat within the operational area. However, considering the distance to its preferred habitat, it is very unlikely the curlew sandpiper will forage in this area but may migrate through it.

Pectoral Sandpiper

The pectoral sandpiper (*Calidris melanotos*) is a listed migratory species under the EPBC Act. This small to medium wader spends non-breeding seasons across Australia but is rare in WA and has been recorded in the coastal Gascoyne, the Pilbara and Kimberley regions, feeding on algae, seeds, crustacean and insects. This species is most commonly found around coastal areas.

According to the PMST report, the pectoral sandpiper may occur or have habitat within the operational area.

Red Knot

The red knot (*Calidris canutus*) is listed as endangered and migratory under the EPBC Act. The red knot is a robust wader which breeds in Siberia and spends the non-breeding season in Australia and New Zealand, specifically in north-western WA (Higgins and Davies, 1996). The non-breeding season is spent on tidal mudflats or sandflats where the omnivorous species feeds on intertidal invertebrates, especially shellfish (Garnet et al., 2011). Although the species is found throughout many suitable habitats in Australia, the highest number of the species is found throughout the northwest of Australia, between Eighty Mile Beach and Roebuck Bay.

According to the PMST report, this species may occur or have habitat within the operational area; however, considering the distance to its preferred habitat, it is very unlikely the red knot will forage in this area but may migrate through it.

Sharp-Tailed Sandpiper

The sharp-tailed sandpiper (*Calidris acuminata*) is listed as a migratory species under the EPBC Act. It is a stout sandpiper that inhabits the muddy margins of freshwater wetlands. The bird forages on bare substrate or in shallow water and inhabits coastal and inland waters throughout Australia. It is widespread in the southwest of WA (Bamford et al., 2008). The bird breeds in northern Siberia (Higgins and Davies, 1996) and departs the breeding grounds in late June, moving down through Asia and New Guinea where it arrives in Australia mid-August. It returns to breeding grounds in April (DoEE, 2017).

According to the PMST report, these species may occur or have habitat within the operational area. This is considered an accurate assessment when they are migrating.

2.9 Other Values and Sensitivities

2.9.1 Australian Marine Parks

There are no Australia Marine Parks within the operational area.

2.9.2 State Marine Parks and Marine Management Areas

There are no State Marine Parks or Marine Management Areas within the operational area.

2.9.3 Key Ecological Features

KEFs are areas of regional importance for either biodiversity or ecosystem function and integrity within the Commonwealth marine environment and have been identified through the marine bioregional planning process (DSEWPaC, 2012b). KEFs meet one or more criteria of:

- a species, group of species or a community with a regionally important ecological role (such as 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)
  - biodiversity and endemism (species which only occur in a specific area).
- a unique seafloor feature, with known or presumed ecological properties of regional significance.

Two KEF overlaps the operational area (Figure 2-7):

- the Continental Slope Demersal Fish Communities KEF:
- the Canyons Linking the Cuvier Abyssal Plain and the Cape Range Peninsula

Continental Slope Demersal Fish Communities

This species assemblage is recognised as a KEF because of its biodiversity values, including high levels of endemism. The diversity of demersal fish assemblages on the continental slope in the Timor Province, the Northwest Transition and the Northwest Province is high compared to elsewhere along the continental slope. The continental slope between North West Cape and the Montebello Trough has more than 500 fish species, 76 of which are endemic, making it the most diverse slope bioregion in Australia. The demersal fish species occupy two distinct demersal community types associated with the upper slope (water depth of 225 to 500 m) and the mid slope (750 to 1000 m).

Canyons Linking the Cuvier Abyssal Plain and the Cape Range Peninsula

This KEF is recognised for its biodiversity values (unique sea-floor feature with ecological properties of regional significance), which apply to both the benthic and pelagic habitats within the KEF. The canyons are associated with upwelling as they channel deep water from the Cuvier Abyssal Plain onto the slope. This nutrient-rich and cooler water interacts with the Leeuwin Current at the canyon heads. Thus, the canyons probably play a part in the enhanced productivity of the Ningaloo Reef system.

The canyons are also repositories for organic and inorganic particulate matter from the shelf and serve as conduits for its transfer from the surface and shelf to greater depths. Aggregations of whale sharks, manta rays, large predatory fish and seabirds are known to occur in the area.

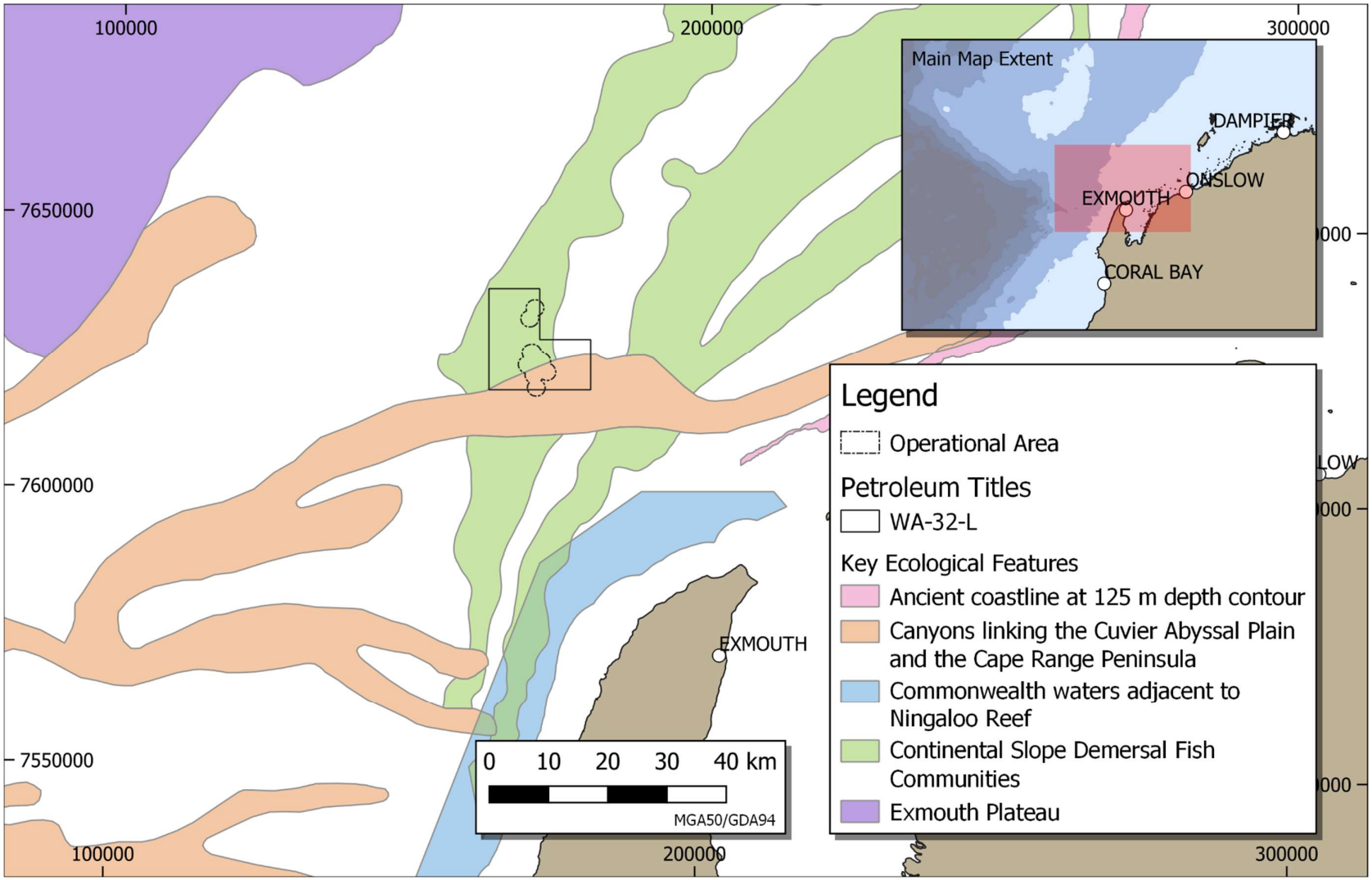

Figure 2-7: Key Ecological Features Within the operational area

2.10 Socio-Economic Values and Sensitivities

2.10.1 Cultural Heritage

There are no Indigenous heritage of underwater cultural heritage properties within the operational area

2.10.2 Australian Commercial Fisheries

Refer to Section 5.6.1 of the EP for details on commercial fisheries within the operational area.

2.10.3 Traditional Fisheries

No traditional fisheries occur within the operational area.

2.10.4 Tourism and Recreation

No tourism and recreational activities occur within the operational area.

2.10.5 Oil and Gas Activities

Refer to Section 5.6.4 of the EP details on oil and gas activities within the operational area.

2.10.6 Commercial Shipping

Refer to Section 5.6.5 of the EP details on defence activities within the operational area.

2.10.7 Defence Activities

Refer to Section 5.6.6 for details on defence activities within the operational area.

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Attachment 1 – Operational Area Protected Matters Search Tool Report

EPBC Act Protected Matters Report

This report provides general guidance on matters of national environmental significance and other matters protected by the EPBC Act in the area you have selected. Please see the caveat for interpretation of information provided here.

Report created: 07-Jun-2022

Summary

Matters of National Environment Significance

This part of the report summarises the matters of national environmental significance that may occur in, or may relate to, the area you nominated. Further information is available in the detail part of the report, which can be accessed by scrolling or following the links below. If you are proposing to undertake an activity that may have a significant impact on one or more matters of national environmental significance then you should consider the Administrative Guidelines on Significance.

World Heritage Properties:	None
National Heritage Places:	None
Wetlands of International Importance (Ramsar	None
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	1
Listed Threatened Ecological Communities:	None
Listed Threatened Species:	20
Listed Migratory Species:	31

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

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 Lands:	None
Commonwealth Heritage Places:	None
Listed Marine Species:	24
Whales and Other Cetaceans:	27
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Australian Marine Parks:	1
Habitat Critical to the Survival of Marine Turtles:	None

Extra Information

This part of the report provides information that may also be relevant to the area you have

State and Territory Reserves:	None
Regional Forest Agreements:	None
Nationally Important Wetlands:	None
EPBC Act Referrals:	24
Key Ecological Features (Marine):	2
Biologically Important Areas:	3
Bioregional Assessments:	None
Geological and Bioregional Assessments:	None

Details

Matters of National Environmental Significance

Commonwealth Marine Area [Resource Information]

Approval is required for a proposed activity that is located within the Commonwealth Marine Area which has, will have, or is likely to have a significant impact on the environment. Approval may be required for a proposed action taken outside a Commonwealth Marine Area but which has, may have or is likely to have a significant impact on the environment in the Commonwealth Marine Area.

Feature Name
EEZ and Territorial Sea

Listed Threatened Species [Resource Information]

Status of Conservation Dependent and Extinct are not MNES under the EPBC Act.
Number is the current name ID.

Scientific Name	Threatened Category	Presence Text
BIRD		
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
Phaethon lepturus fulvus Christmas Island White-tailed Tropicbird, Golden Bosunbird [26021]	Endangered	Species or species habitat may occur within area
Pterodroma mollis Soft-plumaged Petrel [1036]	Vulnerable	Species or species habitat may occur within area

Scientific Name	Threatened Category	Presence Text
Sternula nereis nereis		
Australian Fairy Tern [82950]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thalassarche carteri		
Indian Yellow-nosed Albatross [64464]	Vulnerable	Species or species habitat may occur within area
FISH		
Thunnus maccoyii		
Southern Bluefin Tuna [69402]	Conservation Dependent	Species or species habitat likely to occur within area
MAMMAL		
Balaenoptera borealis		
Sei Whale [34]	Vulnerable	Species or species habitat likely to occur within area
Balaenoptera musculus		
Blue Whale [36]	Endangered	Migration route known to occur within area
Balaenoptera physalus		
Fin Whale [37]	Vulnerable	Species or species habitat likely to occur within area
Eubalaena australis		
Southern Right Whale [40]	Endangered	Species or species habitat may occur within area
REPTILE		
Caretta caretta		
Loggerhead Turtle [1763]	Endangered	Species or species habitat known to occur within area
Chelonia mydas		
Green Turtle [1765]	Vulnerable	Species or species habitat known to occur within area
Dermochelys coriacea		
Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Species or species habitat likely to occur within area

Scientific Name	Threatened Category	Presence Text
Eretmochelys imbricata		
Hawksbill Turtle [1766]	Vulnerable	Species or species habitat known to occur within area
Natator depressus		
Flatback Turtle [59257]	Vulnerable	Congregation or aggregation known to occur within area
SHARK		
Carcharodon carcharias		
White Shark, Great White Shark [64470]	Vulnerable	Species or species habitat may occur within area
Sphyrna lewini		
Scalloped Hammerhead [85267]	Conservation Dependent	Species or species habitat may occur within area

Listed Migratory Species [Resource Information]

Scientific Name	Threatened Category	Presence Text
Migratory Marine Birds		
Anous stolidus		
Common Noddy [825]		Species or species habitat may occur within area
Fregata ariel		
Lesser Frigatebird, Least Frigatebird [1012]		Species or species habitat may occur within area
Macronectes giganteus		
Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Species or species habitat may occur within area
Phaethon lepturus		
White-tailed Tropicbird [1014]		Species or species habitat may occur within area
Thalassarche carteri		
Indian Yellow-nosed Albatross [64464]	Vulnerable	Species or species habitat may occur within area
Migratory Marine Species		
Balaenoptera bonaerensis		
Antarctic Minke Whale, Dark-shoulder Minke Whale [67812]		Species or species habitat likely to occur within area

Scientific Name	Threatened Category	Presence Text
Balaenoptera borealis Sei Whale [34]	Vulnerable	Species or species habitat likely to occur within area
Balaenoptera edeni Bryde's Whale [35]		Species or species habitat likely to occur within area
Balaenoptera musculus Blue Whale [36]	Endangered	Migration route known to occur within area
Balaenoptera physalus Fin Whale [37]	Vulnerable	Species or species habitat likely to occur within area
Carcharhinus longimanus Oceanic Whitetip Shark [84108]		Species or species habitat may occur within area
Carcharodon carcharias White Shark, Great White Shark [64470]	Vulnerable	Species or species habitat may occur within area
Caretta caretta Loggerhead Turtle [1763]	Endangered	Species or species habitat known to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Species or species habitat known to occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Species or species habitat likely to occur within area
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	Species or species habitat known to occur within area
Eubalaena australis as Balaena glacialis australis Southern Right Whale [40]	Endangered	Species or species habitat may occur within area

Scientific Name	Threatened Category	Presence Text
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
Megaptera novaeangliae Humpback Whale [38]		Species or species habitat likely to occur within area
Mobula birostris as Manta birostris Giant Manta Ray [90034]		Species or species habitat likely to occur within area
Natator depressus Flatback Turtle [59257]	Vulnerable	Congregation or aggregation known to occur within area
Orcinus orca Killer Whale, Orca [46]		Species or species habitat may occur within area
Physeter macrocephalus Sperm Whale [59]		Species or species habitat may occur within area
Tursiops aduncus (Arafura/Timor Sea populations) Spotted Bottlenose Dolphin (Arafura/Timor Sea populations) [78900]		Species or species habitat may occur within area
Migratory Wetlands Species		
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat may occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat may occur within area
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat may occur within area

Scientific Name	Threatened Category	Presence Text
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat may occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area

Other Matters Protected by the EPBC Act

Listed Marine Species		[Resource Information]
Scientific Name	Threatened Category	Presence Text
Bird		
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat may occur within area
Anous stolidus Common Noddy [825]		Species or species habitat may occur within area
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 overfly marine area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area overfly marine area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat may occur within area overfly marine area

Scientific Name	Threatened Category	Presence Text
Fregata ariel Lesser Frigatebird, Least Frigatebird [1012]		Species or species habitat may occur within area
Macronectes giganteus Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Species or species habitat may occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area
Phaethon lepturus White-tailed Tropicbird [1014]		Species or species habitat may occur within area
Phaethon lepturus fulvus Christmas Island White-tailed Tropicbird, Golden Bosunbird [26021]	Endangered	Species or species habitat may occur within area
Pterodroma mollis Soft-plumaged Petrel [1036]	Vulnerable	Species or species habitat may occur within area
Thalassarche carteri Indian Yellow-nosed Albatross [64464]	Vulnerable	Species or species habitat may occur within area
Reptile		
Aipysurus laevis Olive Seasnake [1120]		Species or species habitat may occur within area
Caretta caretta Loggerhead Turtle [1763]	Endangered	Species or species habitat known to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Species or species habitat known to occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Species or species habitat likely to occur within area

Scientific Name	Threatened Category	Presence Text
Disteira kingii Spectacled Seasnake [1123]		Species or species habitat may occur within area
Disteira major Olive-headed Seasnake [1124]		Species or species habitat may occur within area
Ephalophis greyi North-western Mangrove Seasnake [1127]		Species or species habitat may occur within area
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	Species or species habitat known to occur within area
Hydrophis elegans Elegant Seasnake [1104]		Species or species habitat may occur within area
Natator depressus Flatback Turtle [59257]	Vulnerable	Congregation or aggregation known to occur within area
Pelamis platurus Yellow-bellied Seasnake [1091]		Species or species habitat may occur within area

Whales and Other Cetaceans [Resource Information]

Current Scientific Name	Status	Type of Presence
Mammal		
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

Current Scientific Name	Status	Type of Presence
Balaenoptera edeni Bryde's Whale [35]		Species or species habitat likely to occur within area
Balaenoptera musculus Blue Whale [36]	Endangered	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
Eubalaena australis Southern Right Whale [40]	Endangered	Species or species habitat may occur within area
Feresa attenuata Pygmy Killer Whale [61]		Species or species habitat may occur within area
Globicephala macrorhynchus Short-finned Pilot Whale [62]		Species or species habitat may occur within area
Grampus griseus Risso's Dolphin, Grampus [64]		Species or species habitat may occur within area
Kogia breviceps Pygmy Sperm Whale [57]		Species or species habitat may occur within area
Kogia sima as Kogia simus Dwarf Sperm Whale [85043]		Species or species habitat may occur within area
Lagenodelphis hosei Fraser's Dolphin, Sarawak Dolphin [41]		Species or species habitat may occur within area

Current Scientific Name	Status	Type of Presence
Megaptera novaeangliae Humpback Whale [38]		Species or species habitat likely to occur within area
Mesoplodon densirostris Blainville's Beaked Whale, Dense-beaked Whale [74]		Species or species habitat may occur within area
Orcinus orca Killer Whale, Orca [46]		Species or species habitat may occur within area
Peponocephala electra Melon-headed Whale [47]		Species or species habitat may occur within area
Physeter macrocephalus Sperm Whale [59]		Species or species habitat may occur within area
Pseudorca crassidens False Killer Whale [48]		Species or species habitat likely to occur within area
Stenella attenuata Spotted Dolphin, Pantropical Spotted Dolphin [51]		Species or species habitat may occur within area
Stenella coeruleoalba Striped Dolphin, Euphrosyne Dolphin [52]		Species or species habitat may occur within area
Stenella longirostris Long-snouted Spinner Dolphin [29]		Species or species habitat may occur within area
Steno bredanensis Rough-toothed Dolphin [30]		Species or species habitat may occur within area
Tursiops aduncus (Arafura/Timor Sea populations) Spotted Bottlenose Dolphin (Arafura/Timor Sea populations) [78900]		Species or species habitat may occur within area

Current Scientific Name	Status	Type of Presence
Tursiops truncatus s. str. Bottlenose Dolphin [68417]		Species or species habitat may occur within area
Ziphius cavirostris Cuvier's Beaked Whale, Goose-beaked Whale [56]		Species or species habitat may occur within area

Australian Marine Parks [Resource Information]

Park Name	Zone & IUCN Categories
Gascoyne	Multiple Use Zone (IUCN VI)

Extra Information

EPBC Act Referrals [Resource Information]

Title of referral	Reference	Referral Outcome	Assessment Status
Controlled action			
Development of Stybarrow petroleum field incl drilling and facility installation	2004/1469	Controlled Action	Post-Approval
Enfield full field development	2001/257	Controlled Action	Post-Approval
Greater Enfield (Vincent) Development	2005/2110	Controlled Action	Post-Approval
Pyrenees Oil Fields Development	2005/2034	Controlled Action	Post-Approval
Not controlled action			
Carnarvon 3D Marine Seismic Survey	2004/1890	Not Controlled Action	Completed
Exploratory drilling in permit area WA-225-P	2001/490	Not Controlled Action	Completed
Subsea Gas Pipeline From Stybarrow Field to Griffin Venture Gas Export Pipeline	2005/2033	Not Controlled Action	Completed
Not controlled action (particular manner)			
3D Seismic Survey, WA	2008/4428	Not Controlled Action (Particular Manner)	Post-Approval
CVG 3D Marine Seismic Survey	2012/6654	Not Controlled Action (Particular	Post-Approval

Title of referral	Reference	Referral Outcome	Assessment Status
Not controlled action (particular manner)			
		Manner)	
Deep Water Northwest Shelf 2D Seismic Survey	2007/3260	Not Controlled Action (Particular Manner)	Post-Approval
Eendracht Multi-Client 3D Marine Seismic Survey	2009/4749	Not Controlled Action (Particular Manner)	Post-Approval
Enfield M3 & Vincent 4D Marine Seismic Surveys	2008/3981	Not Controlled Action (Particular Manner)	Completed
Enfield M3 4D, Vincent 4D & 4D Line Test Marine Seismic Surveys	2008/4122	Not Controlled Action (Particular Manner)	Post-Approval
Enfield oilfield 3D Seismic Survey	2006/3132	Not Controlled Action (Particular Manner)	Post-Approval
Laverda 3D Marine Seismic Survey and Vincent M1 4D Marine Seismic Survey	2010/5415	Not Controlled Action (Particular Manner)	Post-Approval
Rydal-1 Petroleum Exploration Well, WA	2012/6522	Not Controlled Action (Particular Manner)	Post-Approval
Stybarrow 4D Marine Seismic Survey	2011/5810	Not Controlled Action (Particular Manner)	Post-Approval
Stybarrow Baseline 4D marine seismic survey	2008/4530	Not Controlled Action (Particular Manner)	Post-Approval
Vincent M1 and Enfield M5 4D Marine Seismic Survey	2010/5720	Not Controlled Action (Particular Manner)	Post-Approval
Warramunga Non-Inclusive 3D Seismic Survey	2008/4553	Not Controlled Action (Particular Manner)	Post-Approval

Title of referral	Reference	Referral Outcome	Assessment Status
Not controlled action (particular manner)			
Westralia SPAN Marine Seismic Survey, WA & NT	2012/6463	Not Controlled Action (Particular Manner)	Post-Approval
Referral decision			
CVG 3D Marine Seismic Survey	2012/6270	Referral Decision	Completed
Enfield 4D Marine Seismic Surveys, Production Permit WA-28-L	2005/2370	Referral Decision	Completed
Stybarrow Baseline 4D Marine Seismic Survey (Permit Areas WA-255-P, WA-32-L, WA-	2008/4165	Referral Decision	Completed

Key Ecological Features [Resource Information]

Key Ecological Features are the parts of the marine ecosystem that are considered to be important for the biodiversity or ecosystem functioning and integrity of the Commonwealth Marine Area.

Name	Region
Canyons linking the Cuvier Abyssal Plain and the Cape Range Peninsula	North-west
Continental Slope Demersal Fish Communities	North-west

Biologically Important Areas

Scientific Name	Behaviour	Presence
Seabirds		
Ardenna pacifica		
Wedge-tailed Shearwater [84292]	Breeding	Known to occur
Whales		
Balaenoptera musculus brevicauda		
Pygmy Blue Whale [81317]	Distribution	Known to occur
Balaenoptera musculus brevicauda		
Pygmy Blue Whale [81317]	Migration	Known to occur

Caveat

1 PURPOSE

This report is designed to assist in identifying the location of matters of national environmental significance (MNES) and other matters protected by the Environment Protection and Biodiversity Conservation Act 1999 (Cth) (EPBC Act) which may be relevant in determining obligations and requirements under the EPBC Act.

The report contains the mapped locations of:

- World and National Heritage properties;
- Wetlands of International and National Importance;
- Commonwealth and State/Territory reserves;
- distribution of listed threatened, migratory and marine species;
- listed threatened ecological communities; and
- other information that may be useful as an indicator of potential habitat value.

2 DISCLAIMER

This report is not intended to be exhaustive and should only be relied upon as a general guide as mapped data is not available for all species or ecological communities listed under the EPBC Act (see below). Persons seeking to use the information contained in this report to inform the referral of a proposed action under the EPBC Act should consider the limitations noted below and whether additional information is required to determine the existence and location of MNES and other protected matters.

Where data are available to inform the mapping of protected species, the presence type (e.g. known, likely or may occur) that can be determined from the data is indicated in general terms. It is the responsibility of any person using or relying on the information in this report to ensure that it is suitable for the circumstances of any proposed use. The Commonwealth cannot accept responsibility for the consequences of any use of the report or any part thereof. To the maximum extent allowed under governing law, the Commonwealth will not be liable for any loss or damage that may be occasioned directly or indirectly through the use of, or reliance

3 DATA SOURCES

Threatened ecological communities

For threatened ecological communities where the distribution is well known, maps are generated based on information contained in recovery plans, State vegetation maps and remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

Threatened, migratory and marine species

Threatened, migratory and marine species distributions have been discerned through a variety of methods. Where distributions are well known and if time permits, distributions are inferred from either thematic spatial data (i.e. vegetation, soils, geology, elevation, aspect, terrain, etc.) together with point locations and described habitat; or modelled (MAXENT or BIOCLIM habitat modelling) using

Where little information is available for a species or large number of maps are required in a short time-frame, maps are derived either from 0.04 or 0.02 decimal degree cells; by an automated process using polygon capture techniques (static two kilometre grid cells, alpha-hull and convex hull); or captured manually or by using topographic features (national park boundaries, islands, etc.).

In the early stages of the distribution mapping process (1999-early 2000s) distributions were defined by degree blocks, 100K or 250K map sheets to rapidly create distribution maps. More detailed distribution mapping methods are used to update these distributions

4 LIMITATIONS

The following species and ecological communities have not been mapped and do not appear in this report:

- threatened species listed as extinct or considered vagrants;
- some recently listed species and ecological communities;
- some listed migratory and listed marine species, which are not listed as threatened species; and
- migratory species that are very widespread, vagrant, or only occur in Australia in small numbers.

The following groups have been mapped, but may not cover the complete distribution of the species:

- listed migratory and/or listed marine seabirds, which are not listed as threatened, have only been mapped for recorded
- seals which have only been mapped for breeding sites near the Australian continent

The breeding sites may be important for the protection of the Commonwealth Marine environment.

Refer to the metadata for the feature group (using the Resource Information link) for the currency of the information.

Acknowledgements

This database has been compiled from a range of data sources. The department acknowledges the following custodians who have contributed valuable data and advice:

-Office of Environment and Heritage, New South Wales
-Department of Environment and Primary Industries, Victoria
-Department of Primary Industries, Parks, Water and Environment, Tasmania
-Department of Environment, Water and Natural Resources, South Australia
-Department of Land and Resource Management, Northern Territory
-Department of Environmental and Heritage Protection, Queensland
-Department of Parks and Wildlife, Western Australia
-Environment and Planning Directorate, ACT
-Birdlife Australia
-Australian Bird and Bat Banding Scheme
-Australian National Wildlife Collection
-Natural history museums of Australia
-Museum Victoria
-Australian Museum
-South Australian Museum
-Queensland Museum
-Online Zoological Collections of Australian Museums
-Queensland Herbarium
-National Herbarium of NSW
-Royal Botanic Gardens and National Herbarium of Victoria
-Tasmanian Herbarium
-State Herbarium of South Australia
-Northern Territory Herbarium
-Western Australian Herbarium
-Australian National Herbarium, Canberra
-University of New England
-Ocean Biogeographic Information System
-Australian Government, Department of Defence
Forestry Corporation, NSW
-Geoscience Australia
-CSIRO
-Australian Tropical Herbarium, Cairns
-eBird Australia
-Australian Government – Australian Antarctic Data Centre
-Museum and Art Gallery of the Northern Territory
-Australian Government National Environmental Science Program
-Australian Institute of Marine Science
-Reef Life Survey Australia
-American Museum of Natural History
-Queen Victoria Museum and Art Gallery, Inveresk, Tasmania
-Tasmanian Museum and Art Gallery, Hobart, Tasmania
-Other groups and individuals

The Department is extremely grateful to the many organisations and individuals who provided expert advice and information on numerous draft distributions.

Please feel free to provide feedback via the Contact Us page.

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Appendix D. Stakeholder Information Fact Sheet

Petroleum

Invitation for Feedback: Stakeholder Information Fact Sheet

Stybarrow Plug & Abandonment and Decommissioning Environment Plans

Northern Carnarvon Basin, North West Australia

BHP Billiton Petroleum Pty Ltd (BHP) is planning to undertake subsea decommissioning activities for the Stybarrow field which is located within Commonwealth waters in Production Licence WA-32-L, approximately 53 km north-west of Exmouth, Western Australia and in water depths of approximately 810-850 m (Figure 1).

The Stybarrow development was in production from 2007 until 2015 and consisted of the Stybarrow floating production, storage and offloading (FPSO) facility and its mooring, subsea facilities including 10 subsea wells (production and water/gas injectors), the associated trees, manifolds, risers, flowlines, and umbilicals, and the disconnectable turret mooring (DTM) buoy which connected the FPSO to the subsea infrastructure.

Decommissioning of the Stybarrow Field is planned to be undertaken in stages under relevant Commonwealth approvals, with regulatory approvals being sought for the following activities:

- Removal of subsea equipment (wellheads, trees, manifolds, risers, flexible flowlines, umbilicals and the DTM and its moorings);
- Ongoing field management activities, such as equipment inspection and monitoring;.
- The plug and abandonment (P&A) of 10 production/injection wells;
- Removal of the H4 flowline; and
- Proposed leave *in situ* of the DTM anchors (buried) and suction gravity bases for the riser holdbacks and water injection manifold.

This Stakeholder Fact Sheet relates to the activities planned to be managed under two Environment Plans (EPs), these being for:

- The well P&A, H4 flowline removal activities, managed under the Stybarrow P&A Environment Plan (EP).
- The equipment proposed to remain *in situ*, managed under a separate Stybarrow Field Deviation EP.

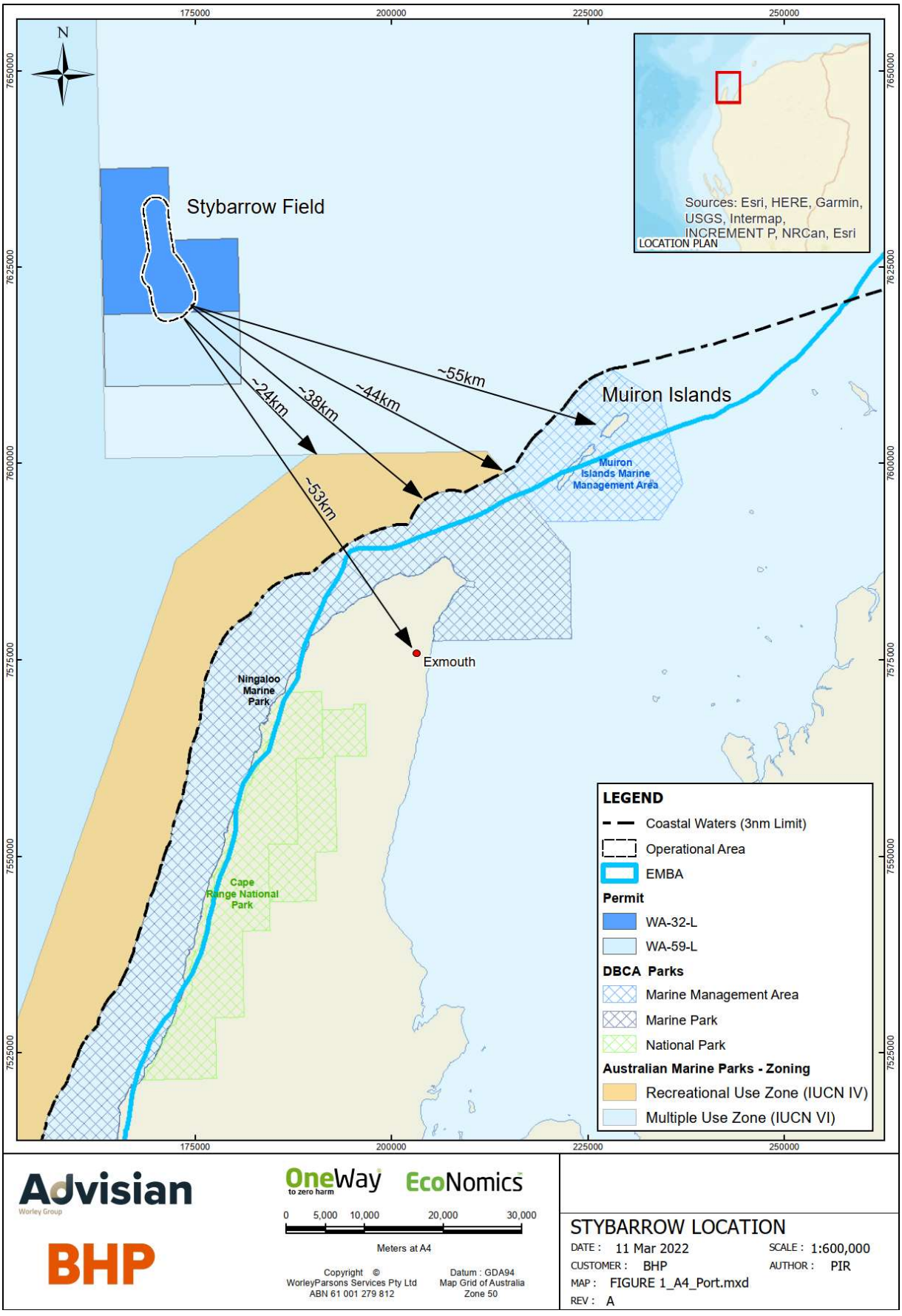
An EP for the subsea equipment removal and ongoing field management activities was submitted in April 2022 and is presently under assessment.

The well P&A and H4 flowline removal activities are planned to commence in 2024, pending approvals, vessel availability and weather constraints. BHP is preparing an EP for this activity for submission to the National Offshore Petroleum Safety and Environmental Management Authority (NOPSEMA) under the Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2009. The EP is being written to allow the activity to occur at any time of year as schedules are subject to change and to allow our business flexibility. The P&A activities are required to be completed no later than 30 September 2024 and equipment removal completed no later than 31 March 2025.

BHP Billiton Petroleum (Australia) Pty Ltd is the designated operator on behalf of a joint venture comprising BHP Billiton Petroleum (Australia) Pty Ltd and Woodside Energy Ltd (Woodside), which are the holders of Production Licence WA-32-L.

Document number: 411012-00432-20000-REP-0001_Rev0 20220526

Figure 1 Stybarrow Location



Location of Operational Area

The Operational Area defines the spatial boundary within which the proposed activities will take place (Figure 1 and Figure 2). The Operational Area is temporary for the duration of activities and will comprise a 1,500 m radius around the wells and subsea infrastructure. The nearest point to mainland shore from the Operational Area is approximately 42 km (near the tip of North West Cape) and the closest major town is Exmouth, approximately 52 km to the south east. There are several Commonwealth and State Marine protected areas in the region, the closest being the Gascoyne Australian Marine Park in Commonwealth waters, which is approximately 5 km west of the Operational Area (Figure 1 and Table 1).

Table 1 Marine protected areas in the region

Value/ Sensitivity	Approx. Distance from Operational Area
Gascoyne Australian Marine Park (Commonwealth)	5 km
Ningaloo Australian Marine Park (Commonwealth)	24 km
Ningaloo Marine Park (Western Australia)	36 km
Muiron Islands Marine Management Area (Western Australia)	45 km

Description of Activity

Within the scope of EPs covered by this fact sheet, BHP proposes to:

- Plug and abandon the 10 Stybarrow development wells
- Remove the H4 flowline which was blocked due to a sanding event during production. BHP has assessed that the impact to the marine environment would be a release of up to 14m^3 in the event that any hydrocarbons are released during recovery of the flowline.

At the conclusion of these activities, BHP is proposes that the following equipment will be left in situ:

- 9 DTM mooring anchors;
- 9 suction pile riser bases; and
- The suction pile foundation for the water injection manifold.

BHP has undertaken an environmental impact assessment of the feasible decommissioning options for the equipment proposed to be left *in situ*. This assessment concluded that leaving these items *in situ* was a better environmental outcome due to:

- the environmental damage caused by their removal, given they are deeply embedded in the seabed.
- the very low environmental risk associated with the degradation of equipment. The items are of steel construction and do not contain plastics or other known contaminants. The degradation products of steel are not considered toxic and these materials are routinely used in the construction of marinas, breakwaters etc.
- minimal impact to other users of the sea, due to the water depth (800m+)

The locations of the wellheads, H4 flowline and equipment proposed to be left *in situ* are provided in Table 3.

A detailed inventory of subsea infrastructure to be removed or left *in situ* under these activity scopes is included in the respective EPs, which will be available on NOPSEMA's website (https://www.nopsema.gov.au/) upon submission.

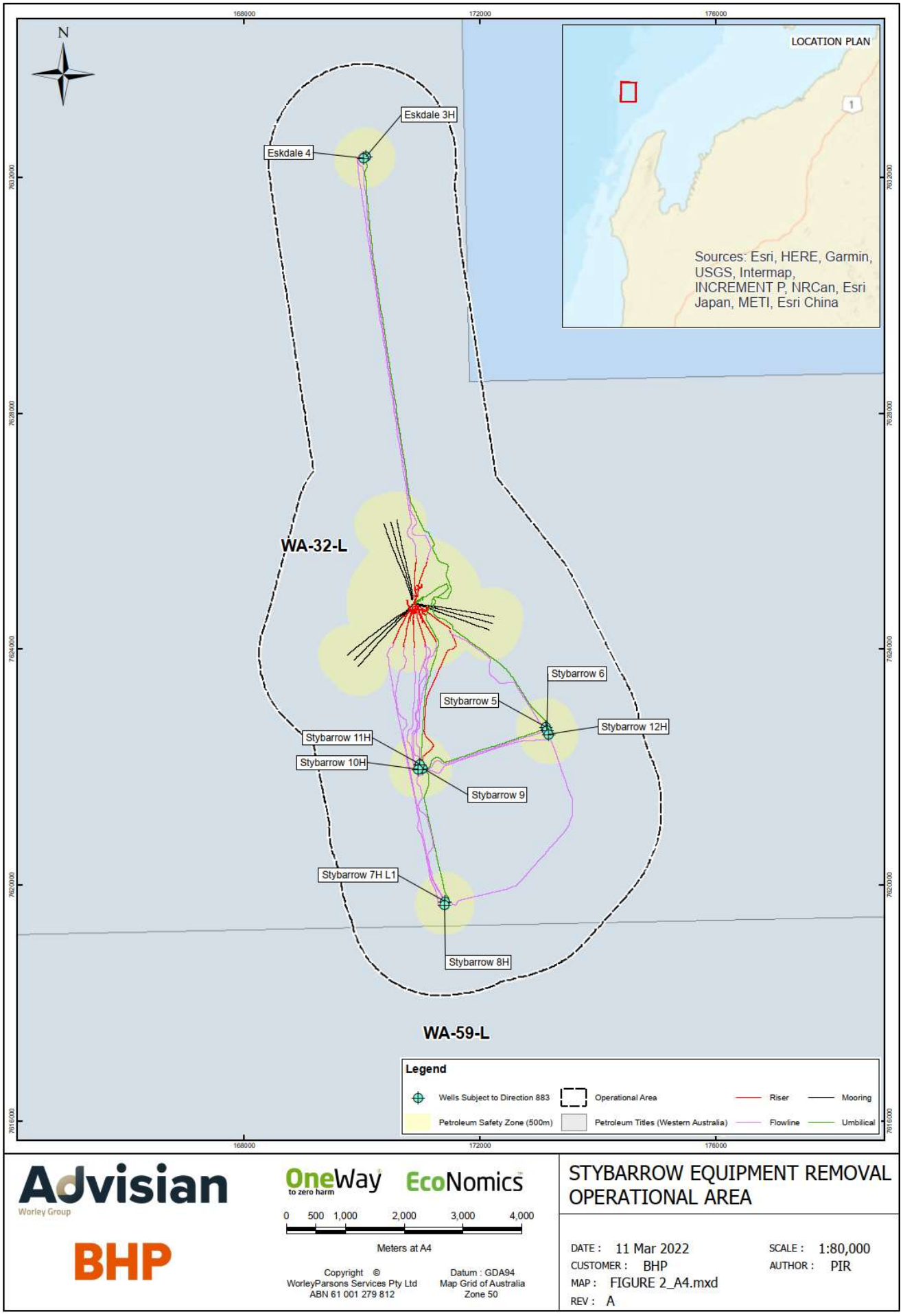


Figure 2 **Equipment Removal Activity Operational Area**

Table 2 Summary of decommissioning activities

Stybarrow Subsea Infrastructure Decommissioning Activities	
Earliest expected commencement date	Earliest P&A start is 2024 calendar year, subject to approvals, MODU and vessel availability, and weather constraints. P&A must be completed no later than 30 September 2024.
Petroleum title	Production Licence WA-32-L
Operational area	A 500 m safety exclusion zone around the wells and a 1,500 m radius temporary Operational Area (precautionary) around the wells and subsea equipment for the duration of the activity.
Petroleum Safety Zones	500 m radius around wells 1,134 m radius around former FPSO location
Estimated duration	Approximately 6 months
Water depth	Approximately 810-850 m
Activities proposed	P&A of 10 wells Removal of 1 x flexible production flowline, ~2000m long
Vessels	Semi submersible mobile offshore drilling unit (MODU) (Dynamic positioning) Offshore support vessels, such as general support/supply vessels, construction support vessels/installation vessels. Typically, two (but up to six) project vessels will be in the Operational Area during well P&A and subsea infrastructure removal activities.

Table 3 Location of subsea infrastructure and activity. All coordinates in MGA50/GDA94

Subsea infrastructure	Easting	Northing	Activity
H4 flowline	Between H4 well and riser, approximately ~2000m in length		Remove. Flowline was blocked with sand/hydrocarbons/hydrate during production. Up to 14m3 of hydrocarbons could potentially be released during its recovery (unplanned)
Eskdale-4 (EG1) Well	170024.53	7632318.26	Plug and abandon. Wellhead and subsea tree removal is covered under the Equipment Removal EP
Stybarrow-5 (I-3) Well	173119.00	7622683.90	
Stybarrow-6 (I-2) Well	173143.86	7622636.19	
Stybarrow-12 (H-5) Well	173172.80	7622560.74	
Stybarrow-9 (I-1) Well	171032.33	7621985.59	
Stybarrow-10 (H-3) Well	170958.06	7621964.06	
Stybarrow-11 (H-4) Well	170980.53	7622056.34	
Stybarrow-7 (H-2) Well	171413.34	7619728.58	
Stybarrow-8 (H-1) Well	171403.11	7619659.88	
Eskdale-3 (EH1) Well	170065.05	7632345.32	
Eskdale-4 (EG1) Well	170024.53	7632318.26	
Water injection manifold suction base	171486.5	7624333.0	Leave in Situ proposed (flush with seabed), 4m in diameter, 7m high
Mooring 1 Anchor	172172.4	7624323.5	Leave in Situ Proposed (buried) Anchors are 11 tonne Stevpris Mk5 Vryhof anchors, ~6m x 6m x 3m
Mooring 2 Anchor	172215.2	7624441.7	
Mooring 3 Anchor	172237.1	7624561.1	
Mooring 4 Anchor	170594.8	7626195	

Subsea infrastructure	Easting	Northing	Activity
Mooring 5 Anchor	170489.2	7626161.1	
Mooring 6 Anchor	170372.9	7626127.5	
Mooring 7 Anchor	169759.4	7623909.3	
Mooring 8 Anchor	169828.7	7623775.8	
Mooring 9 Anchor	169943.1	7623715.9	
Dynamic Umbilical Riser Base	171433.8	7625113.9	Riser bases embedded in seabed – leave in situ proposed. Clamps and chains removed. Riser bases are 4m in diameter, 7m high.
Water Injection 10" Riser base	171491.8	7624359.1	
H4GL Gas Lift 6" Riser Base	171256.2	7624136.9	
EG1 Gas Injection 6" Riser Base	171121.0	7625533.9	
H4 Production 8" Riser Base	171080.4	7624061.0	
H3 Production 8" Riser Base	170894.3	7624028.6	
H2 Production 7" Riser Base	170704.2	7624040.9	
H1 Production 7" Riser Base	170526.5	7624100.2	
EH1 Production 6" Riser Base	170921.2	7625578.0	

Summary of potential risks and associated management measures

Potential risks and management measures associated with the activity have been considered and are summarised in Table 4.

Table 4 Potential risks and associated management measures

Potential Risks	Management and/or mitigation measures
Planned Activities	
Physical presence	• BHP's existing infrastructure is marked on nautical charts. • Establishment of a 500 m safety exclusion zone around the wells and a 1500 m Operational Area for the duration of the activity. • Consultation with relevant stakeholders (e.g., adjacent petroleum titleholders, commercial fishers and their representative organisations, government departments and agencies and local communities) to inform decision making for the proposed activity and the development of the Environment Plan. • BHP will notify relevant fishing industry representative organisations/associations and Government maritime safety agencies of the start and end dates for the activity, the MODU location and details of exclusion zones prior to commencement of the P&A and other removal activities.
Light emissions	• Lighting is minimised to that required for safety and navigational purposes.
Noise Emissions	• Measures will be in place for interacting with protected marine fauna as per the EPBC Regulations (Part 8) and consistent with relevant Conservation Management Plans • Engines, compressors and machinery on the vessel are maintained via the vessel preventative maintenance system (PMS) to ensure equipment is operating efficiently.
Atmospheric emissions	• Air emissions from marine engines meet MARPOL requirements and are routinely maintained. • Marine-grade (low sulphur) diesel to be used.
Routine vessel discharges	• Routine discharges and vessel waste treatment systems will meet legal / MARPOL requirements. • No discharge of oily water exceeding 15 ppm oil in water content. • Food-scraps macerated prior to discharge. • Maintain biosecurity requirements such as anti-fouling certification, ballast water and biofouling controls.

Potential Risks	Management and/or mitigation measures
	• Chemical use will be managed in accordance with BHP and contractor chemical selection and approval procedures
Subsea discharges	• Chemical use will be managed in accordance with BHP and contractor chemical selection and approval procedures. • All routine marine discharges will be managed according to legislative and regulatory requirements and BHP's Environment Performance Standards where applicable.
Unplanned Risks	
Unplanned releases, including hydrocarbons	• All personnel undertaking activities will undergo relevant inductions and training • Procedures for lifts, equipment maintenance, inspections and bunding • All offshore activities will be manged in accordance with lifting and transfer procedures • Well barrier management shall be implemented, tested and monitored • Recovery of solid wastes overboard where safe and practicable to do so • Implementation of Oil Pollution Emergency Plan (OPEP). • No heavy fuels used – only marine diesel oil (MDO). • Appropriate vessel spill response plans, equipment and materials will be in place and maintained
Marine fauna interaction	• Measures will be in place for interacting with protected marine fauna as per the Environment Protection Biodiversity Conservation (EPBC) Regulations (Part 8).
Introduced marine species	• BHP contracted vessels comply with Australian biosecurity requirements and guidance, and Australian ballast water requirements. • Vessels will be assessed and managed in line with BHP procedures to prevent the introduction of invasive marine species.
Vessel collision	• Marine notifications will be made to relevant stakeholders, describing the location of the activity and exclusion/cautionary zones to prevent the risk of vessel collisions

Protecting Our People and the Environment

Safety of our people and the communities in which we operate always comes first. Identifying, controlling, and mitigating safety risks is managed through an overarching, consistent approach guided by BHP's Risk Management governance framework, with supporting processes and performance standards. All activities (routine and non-routine) will be performed in accordance with the industry-leading standards established in BHP's Charter, HSEC Framework and Controls, BHP's Wells and Seismic Delivery Management System, Engineering Standards and Procedures, the Environment Plan and the NOPSEMA-accepted Well Operations Management Plan (WOMP) and NOPSEMA-accepted Vessel Safety Case.

Offshore petroleum activities are regulated through a robust and comprehensive environmental protection regime administered by NOPSEMA under the Commonwealth *Offshore Petroleum and Greenhouse Gas Storage Act 2006*. BHP undertakes risk assessments for all environmental aspects of a petroleum activity and stringently adheres to the regulatory regime.

The objective of the Environment Plan is to ensure that potential adverse impacts on the environment associated with activities, during both routine and non-routine activities, are identified, and will be continuously reduced to as low as reasonably practicable (ALARP) and an acceptable level. BHP is committed to understanding the impacts of our activities on stakeholders with an interest in the Stybarrow field and seeks feedback as part of the development of the EP.

Responding to Emergencies

BHP's incident response plans are accepted by the regulator NOPSEMA. The Commonwealth Oil Pollution Emergency Plan (OPEP) is required by law under the Environmental Regulations and forms an appendix to the full EP. The OPEP outlines responsibilities, specific procedures and identifies resources available in the unlikely event of an oil pollution incident. BHP maintains a constant vigilance and readiness to prevent and/or respond to hydrocarbon loss of containment incidents. The readiness and competency of BHP to respond to incidents is maintained and tested by conducting activity-specific emergency response exercises.

Should you have any questions, concerns or grievances regarding these activities or any other BHP Petroleum activities, please call BHP WA Community Hotline on **1800 421 077** or send an email to **bhppetexternalaffairs@bhp.com**

BHP believes in putting health and safety first, being environmentally responsible and supporting our communities.

Petroleum

Invitation for Feedback: Stakeholder Information Fact Sheet

Stybarrow Equipment Removal Environment Plan

Northern Carnarvon Basin, North West Australia

The Stybarrow field is located within Commonwealth waters in Production Licence WA-32-L, approximately 53 km north-west of Exmouth, Western Australia and in water depths of approximately 810-850 m (Figure 1). The Stybarrow development was in production from 2007 to 2015 and consisted of the Stybarrow floating production, storage and offloading (FPSO) facility and its mooring; subsea facilities including ten subsea wells (production and water/gas injectors), the associated trees, manifolds, risers, flowlines, and umbilicals, and the disconnectable turret mooring (DTM) buoy which connected the FPSO to the subsea infrastructure.

Decommissioning of the Stybarrow Field is planned to be undertaken in stages under relevant Commonwealth approvals, with the first approvals being sought for the removal of the subsea equipment and ongoing field management activities until the equipment is removed. These activities will be managed under the Stybarrow Equipment Removal Environment Plan (EP). The well plug and abandonment (P&A) and equipment proposed to remain in situ will be subject to separate future environmental approvals.

Since 2015, the following cessation activities have been completed:

- All flowlines and gas lift lines were flushed and filled with treated seawater and production flowlines disconnected (except for an abandoned flowline which was blocked by sand and gas hydrate during production, which is disconnected, sealed, and lying on the seabed).
- All production, gas injection and water injection wells were shut in and capped.
- The Stybarrow Venture FPSO was disconnected from the DTM and departed in August 2015

The DTM unexpectedly sank to the seabed in mid-2016, and currently lies in approximately 825 m water depth. Following the DTM sinking, BHP removed all buoyancy modules from the risers to eliminate the risk of floating equipment coming to the sea surface.

BHP is now planning for the safe removal of remaining equipment from the Stybarrow field. Details on the equipment removal activities are provided below in the Description of the Activity section.

This Stakeholder Fact Sheet relates to the submission of the Environment Plan (EP) for the proposed petroleum activities in WA-32-L supporting equipment removal activities for the Stybarrow facilities.

The activity is planned to commence in 2024, pending approvals, vessel availability and weather constraints. BHP is preparing an EP for this activity for submission to the National Offshore Petroleum Safety and Environmental Management Authority (NOPSEMA) under the Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2009. The EP is being written to allow the activity to occur at any time of year as schedules are subject to change and to allow our business flexibility.

BHP Billiton Petroleum (Australia) Pty Ltd is the designated operator on behalf of a joint venture comprising BHP Billiton Petroleum (Australia) Pty Ltd and Woodside Energy Ltd (Woodside), which are the holders of Production Licence WA-32-L.

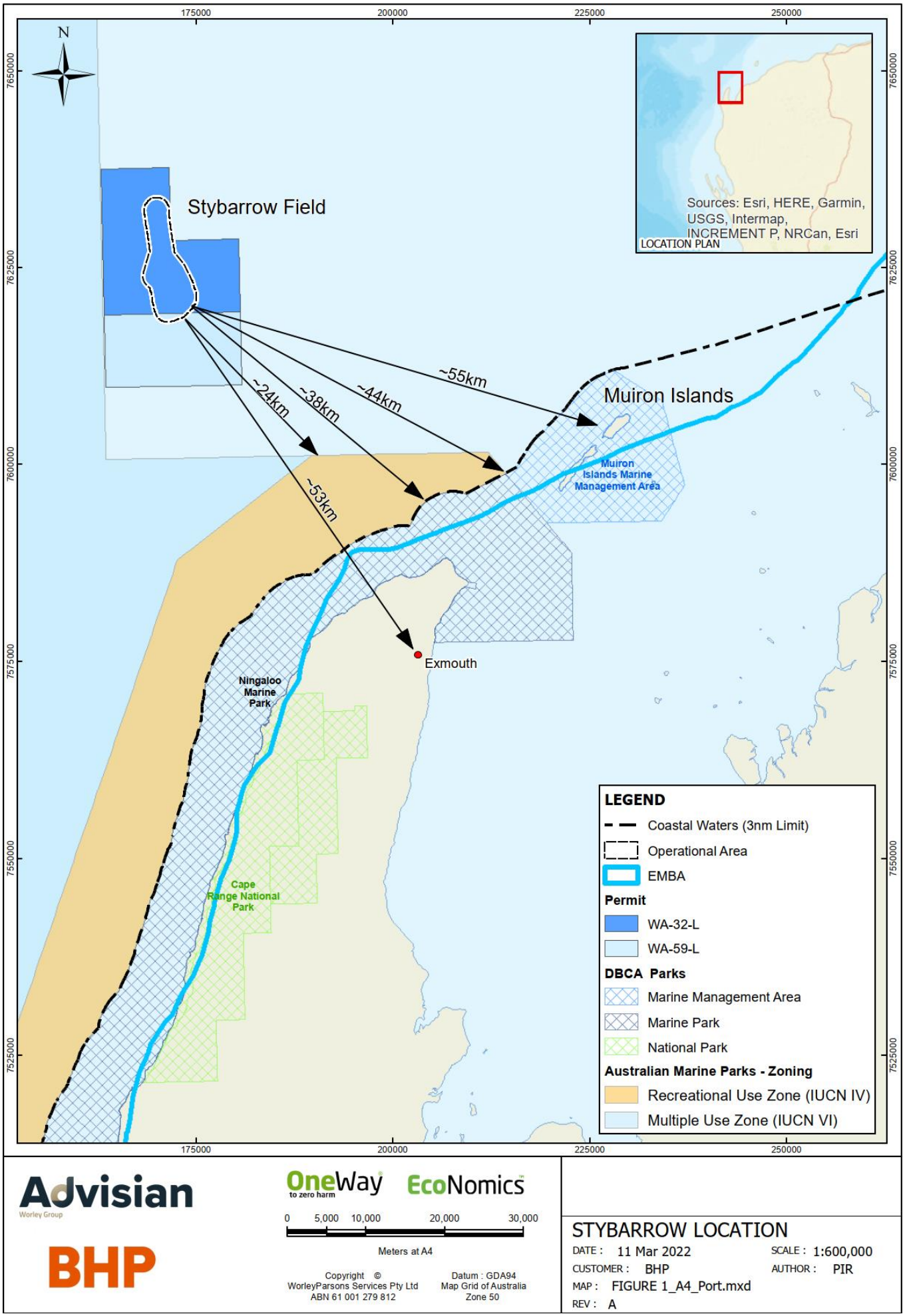


Figure 1 Stybarrow Location

Location of Operational Area

The Operational Area defines the spatial boundary within which the proposed activities will take place (Figure 1 and Figure 2). The Operational Area is temporary for the duration of activities and will comprise a 1,500 m radius around the wells and subsea infrastructure. The nearest point to mainland shore from the Operational Area is approximately 42 km (near the tip of North West Cape) and the closest major town is Exmouth, approximately 52 km to the south east. There are several Commonwealth and State Marine protected areas in the region, the closest being the Gascoyne Australian Marine Park in Commonwealth waters, which is approximately 5 km west of the Operational Area (Figure 1 and Table 1).

Table 1 Marine protected areas in the region

Value/ Sensitivity	Approx. Distance from Operational Area
Gascoyne Australian Marine Park (Commonwealth)	5 km
Ningaloo Australian Marine Park (Commonwealth)	24 km
Ningaloo Marine Park (Western Australia)	36 km
Muiron Islands Marine Management Area (Western Australia)	45 km

Description of Activity

Within the scope of the equipment removal EP, BHP proposes to:

- Remove subsea infrastructure within the Stybarrow field in Production Licence WA-32-L.
- Remove wellheads and associated infrastructure within Production Licence WA-32-L.
- Continue field management scopes on the subsea infrastructure, which comprise of inspection, maintenance, monitoring, and repair (IMMR) and remotely operated vehicle (ROV) surveys on the subsea infrastructure, as required, to ensure equipment remains in a condition that does not preclude full recovery.

Equipment will only be removed after the P&A of the wells, which is subject to a future approval.

The equipment to be removed is summarised in Table 2. Locations of the equipment are provided in Table 3.

Upon removal, BHP proposes to dispose of equipment onshore in accordance with applicable requirements. BHP will assess options to reduce waste through re-use or recycling of recovered equipment.

One flowline which is planned to be retrieved was blocked due to a sanding event during production. BHP has assessed the impact to the marine environment would be a release of up to 14m^3 in the event that any hydrocarbons are released during recovery of the flowline.

At the conclusion of the removal activity, the nine DTM mooring anchors, nine riser base anchors and the suction pile foundation for the water injection manifold will remain in the Stybarrow field. These large steel items are securely embedded in the seabed and their removal will result in substantial disturbance to the environment. BHP is considering leaving these items *in situ* and will submit a future EP to NOPSEMA which seeks to leave these items in place. BHP will undertake further consultation to support this future EP.

A detailed inventory of subsea infrastructure to be removed under this scope will be included in the EP, which will be available on NOPSEMA's website (https://www.nopsema.gov.au/) upon submission.

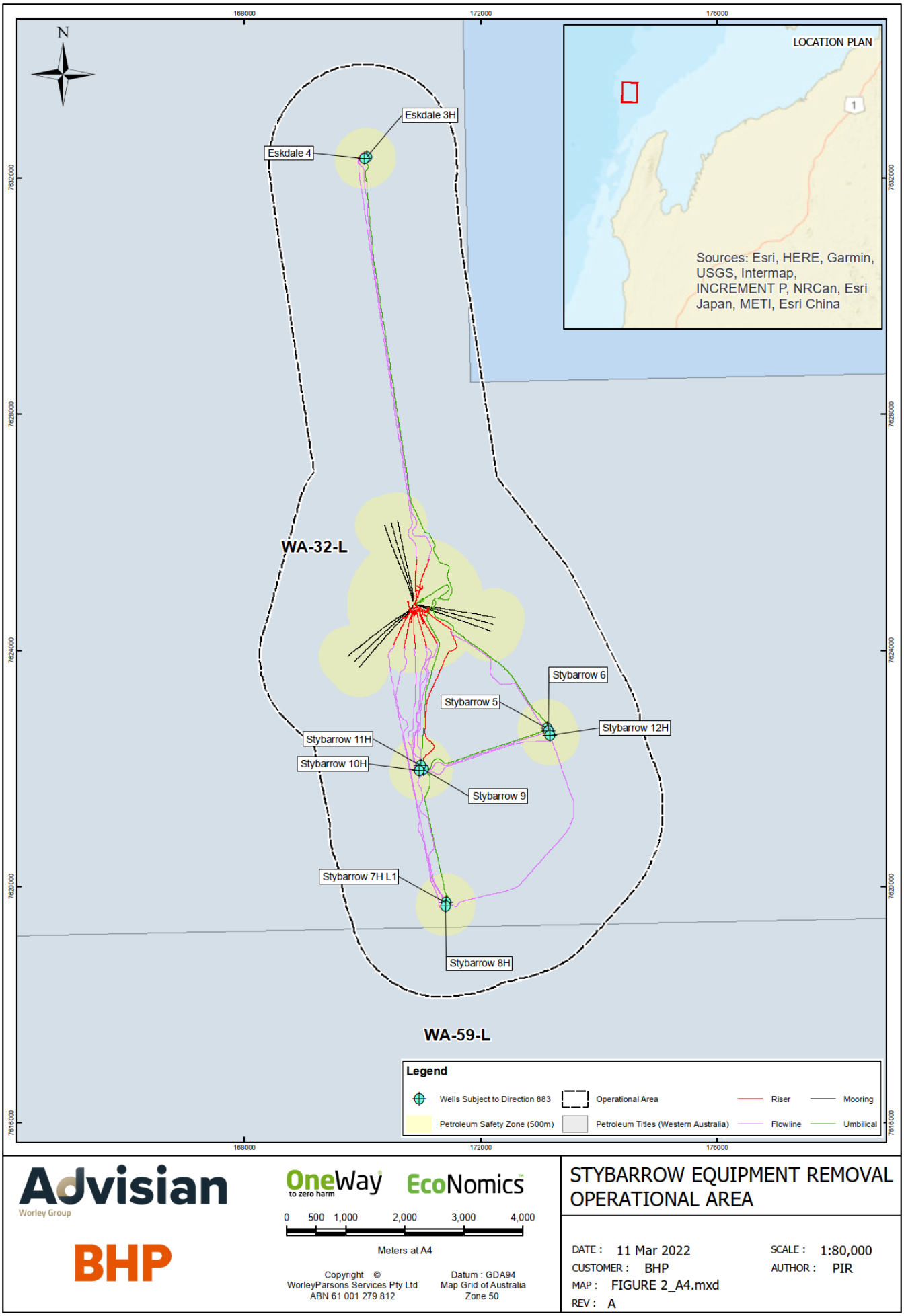


Figure 2 **Equipment Removal Activity Operational Area**

Table 2 Summary of decommissioning activities

Stybarrow Subsea Infrastructure Decommissioning Activities	
Earliest expected commencement date	Earliest start is 2024 calendar year, subject to approvals, vessel availability, and weather constraints.
Petroleum title	Production Licence WA-32-L
Operational area	A 500 m safety exclusion zone around the wells and a 1,500 m radius temporary Operational Area (precautionary) around the wells and subsea equipment for the duration of the activity.
Petroleum Safety Zones	500 m radius around wells and mooring anchors 1,134 m radius around former FPSO location
Estimated duration	Approximately 6 months
Water depth	Approximately 810-850 m
Equipment to be removed	1 x DTM 9 x DTM mooring legs 9 x Mooring support buoys 9 x Flexible risers 8 x Flexible production flowlines 4 x Gas injection / lift flowlines 2 x Water injection flowlines All flying leads, umbilicals, and jumpers 1 x Water injection manifold 7 x Subsea distribution units (SDU) / umbilical termination assemblies (UTAs) 15 x Anode skids 10 x Xmas trees and wellheads
Vessels	Offshore support vessels are planned to be used to remove subsea infrastructure, such as general support/supply vessels, diving support vessels/installation vessels and anchor handling tugs. Typically, two (but up to six) project vessels will be in the Operational Area during subsea infrastructure removal activities. General support vessels will be used to transport equipment to and from the Operational Area. Typically, only one general support vessel will be performing field management in the Operational Area at any time.

Table 3 Location of subsea infrastructure and removal activity. All coordinates in MGA50/GDA94

Subsea infrastructure	Easting	Northing	Activity
DTM buoy	170873.2	7624770.8	Remove
DTM mooring legs – chain and wire	Between anchors and DTM buoy		Remove
Mooring 1 Anchor	172172.4	7624323.5	Embedded in seabed - leave in situ proposed, subject to a future EP
Mooring 2 Anchor	172215.2	7624441.7	
Mooring 3 Anchor	172237.1	7624561.1	
Mooring 4 Anchor	170594.8	7626195	
Mooring 5 Anchor	170489.2	7626161.1	
Mooring 6 Anchor	170372.9	7626127.5	
Mooring 7 Anchor	169759.4	7623909.3	

Subsea infrastructure	Easting	Northing	Activity
Mooring 8 Anchor	169828.7	7623775.8	
Mooring 9 Anchor	169943.1	7623715.9	
Mooring support buoys	With mooring legs		Remove
Flexible risers	Between DTM buoy and flowlines		Remove
Dynamic Umbilical Riser Base	171433.8	7625113.9	Clamps and chains removed. Riser bases embedded in seabed – leave in situ proposed, subject to a future EP
Water Injection 10" Riser base	171491.8	7624359.1	
H4GL Gas Lift 6" Riser Base	171256.2	7624136.9	
EG1 Gas Injection 6" Riser Base	171121.0	7625533.9	
H4 Production 8" Riser Base	171080.4	7624061.0	
H3 Production 8" Riser Base	170894.3	7624028.6	
H2 Production 7" Riser Base	170704.2	7624040.9	
H1 Production 7" Riser Base	170526.5	7624100.2	
EH1 Production 6" Riser Base	170921.2	7625578.0	
Flexible production flowlines	Between risers and drill centres		Remove
Gas injection / lift flowlines			Remove
Water injection flowlines			Remove
Umbilicals			Remove
Jumpers	Within drill centres		Remove
Water injection manifold (suction anchor)	171486.5	7624333.0	Remove
Riser Base SDU	171223.8	7624891.4	Remove
SDU A	173159.3	7622671.3	Remove
SDU B	171004.5	7622008.6	Remove
SDU C	171441.3	7619702.8	Remove
SDU D	170065.5	7632321.3	Remove
DC-A UTA	173183.0	7622582.1	Remove
DC-B UTA	171019.6	7621973.9	Remove
Anode skids	Various		Remove
Stybarrow-5 (I-3) Well	173119.00	7622683.90	Remove
Stybarrow-6 (I-2) Well	173143.86	7622636.19	Remove
Stybarrow-12 (H-5) Well	173172.80	7622560.74	Remove
Stybarrow-9 (I-1) Well	171032.33	7621985.59	Remove
Stybarrow-10 (H-3) Well	170958.06	7621964.06	Remove
Stybarrow-11 (H-4) Well	170980.53	7622056.34	Remove
Stybarrow-7 (H-2) Well	171413.34	7619728.58	Remove
Stybarrow-8 (H-1) Well	171403.11	7619659.88	Remove
Eskdale-3 (EH1) Well	170065.05	7632345.32	Remove
Eskdale-4 (EG1) Well	170024.53	7632318.26	Remove

Summary of potential risks and associated management measures

Potential risks and management measures associated with the activity have been considered and are summarized in Table 4.

Table 4 Potential risks and associated management measures

Potential Risks	Management and/or mitigation measures
Planned Activities	
Physical presence	• BHP's existing infrastructure is marked on nautical charts. • Establishment of a 500 m safety exclusion zone around the wells and a 1500 m Operational Area for the duration of the activity. • Consultation with relevant stakeholders (e.g., adjacent petroleum titleholders, commercial fishers and their representative organisations, government departments and agencies and local communities) to inform decision making for the proposed activity and the development of the Environment Plan. • BHP will notify relevant fishing industry representative organisations/associations and Government maritime safety agencies of the start and end dates for the activity, and details of exclusion zones prior to commencement of the activity.
Light emissions	• Lighting is minimised to that required for safety and navigational purposes.
Noise Emissions	• Engines, compressors and machinery on the vessel are maintained via the vessel preventative maintenance system (PMS) to ensure equipment is operating efficiently.
Atmospheric emissions	• Air emissions from marine engines meet MARPOL requirements and are routinely maintained. • Marine-grade (low sulphur) diesel to be used.
Routine vessel discharges	• Routine discharges and vessel waste treatment systems will meet legal / MARPOL requirements. • No discharge of oily water exceeding 15 ppm oil in water content. • Food-scraps macerated prior to discharge. • Maintain biosecurity requirements such as anti-fouling certification, ballast water and biofouling controls.
Seabed disturbance	• Minimise disturbance where possible noting that physical removal of subsea infrastructure may have measurable but limited impacts to the environment, where recovery of ecosystem function is expected within <1 year.
Subsea discharges	• Chemical use will be managed in accordance with BHP and contractor chemical selection and approval procedures. • All routine marine discharges will be managed according to legislative and regulatory requirements and BHP's Environment Performance Standards where applicable.
Waste generation	• Waste generated aboard the support 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 marine environment. • Wastes transported onshore will be sent to appropriate recycling or disposal facilities by a licenced waste contractor.
Unplanned Risks	
Hydrocarbon release-marine diesel	• Comply with the AMSA-approved Shipboard Oil Pollution Emergency Plan (SOPEP), including maintaining spill kits, emergency response procedures and conducting spill response exercises. • Implementation of Oil Pollution Emergency Plan (OPEP). • No heavy fuels used – only marine diesel oil (MDO).
Marine fauna interaction	• Measures will be in place for interacting with protected marine fauna as per the Environment Protection Biodiversity Conservation (EPBC) Regulations (Part 8). • Environmental awareness induction for all marine crew. • Maintain caution and 'no approach' zones from cetaceans. • Report any injury/mortality of EPBC-listed fauna to the Department of Agriculture, Water and the Environment.

Potential Risks	Management and/or mitigation measures
Introduced marine species	• BHP contracted vessels comply with Australian biosecurity requirements and guidance, and Australian ballast water requirements. • Vessels will be assessed and managed in line with BHP procedures to prevent the introduction of invasive marine species.
Minor spills of chemicals or hydraulic fluid	• Project vessels have an approved SOPEP (as appropriate to vessel class) in accordance with Marine Order 91 (marine pollution prevention – oil) • Chemical use will be managed in accordance with BHP and contractor chemical selection and approval procedures. • Critical hoses outside bunded areas (such as ROVs) are inspected and maintained as part of PMS.
Loss of solid hazardous or non-hazardous wastes (including dropped objects)	• Recovery of solid wastes lost overboard where safe and practicable to do so.

Protecting Our People and the Environment

Safety of our people and the communities in which we operate always comes first. Identifying, controlling, and mitigating safety risks is managed through an overarching, consistent approach guided by BHP's Risk Management governance framework, with supporting processes and performance standards. All activities (routine and non-routine) will be performed in accordance with the industry-leading standards established in BHP's Charter, HSEC Framework and Controls, BHP's Wells and Seismic Delivery Management System, Engineering Standards and Procedures, the Environment Plan and the NOPSEMA-accepted Well Operations Management Plan (WOMP) and NOPSEMA-accepted Vessel Safety Case.

Offshore petroleum activities are regulated through a robust and comprehensive environmental protection regime administered by NOPSEMA under the Commonwealth *Offshore Petroleum and Greenhouse Gas Storage Act 2006*. BHP undertakes risk assessments for all environmental aspects of a petroleum activity and stringently adheres to the regulatory regime.

The objective of the Environment Plan is to ensure that potential adverse impacts on the environment associated with activities, during both routine and non-routine activities, are identified, and will be continuously reduced to as low as reasonably practicable (ALARP) and an acceptable level. BHP is committed to understanding the impacts of our activities on stakeholders with an interest in the Stybarrow field and seeks feedback as part of the development of the EP.

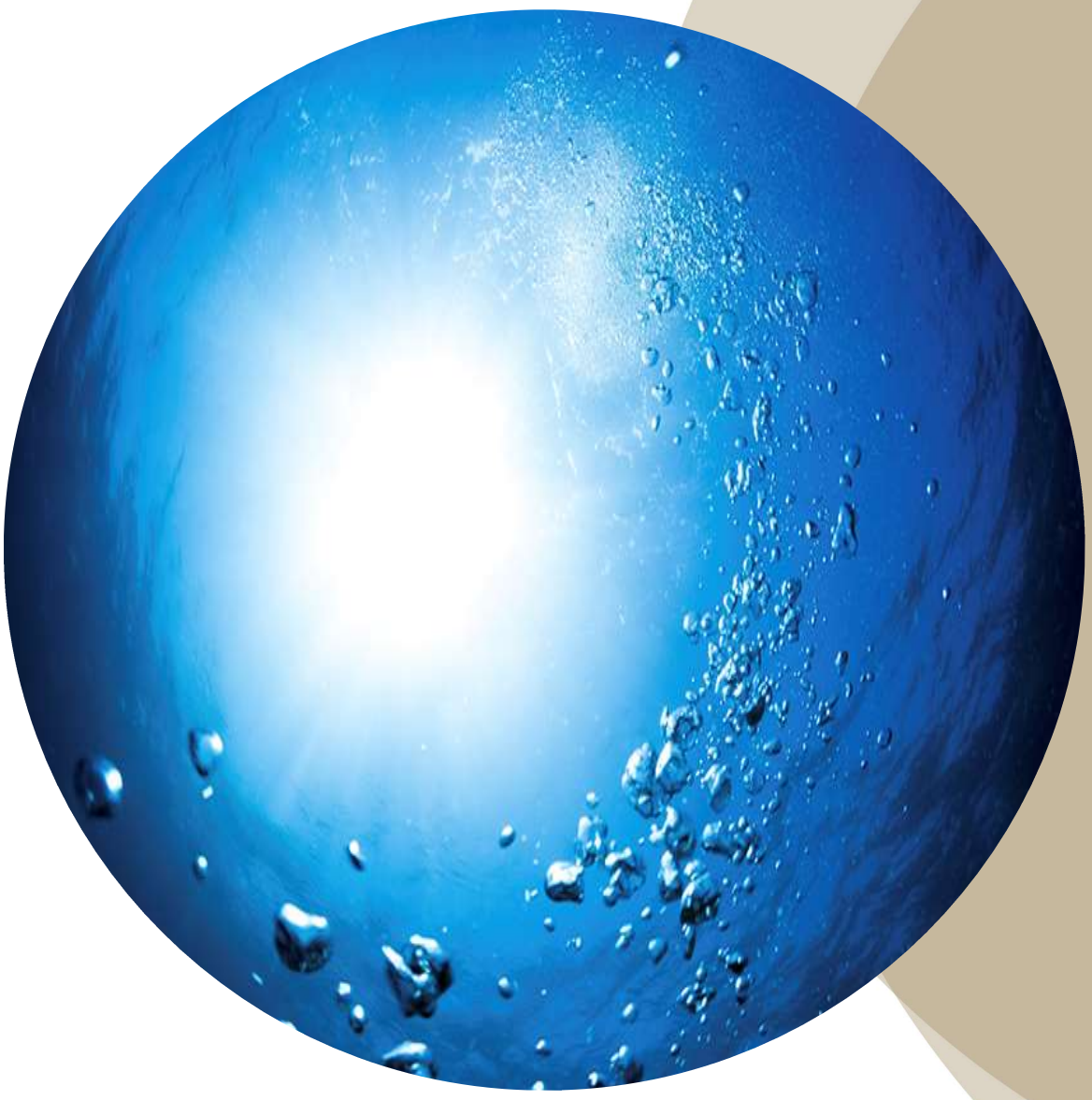
Responding to Emergencies

BHP's incident response plans are accepted by the regulator NOPSEMA. The Commonwealth Oil Pollution Emergency Plan (OPEP) is required by law under the Environmental Regulations and forms an appendix to the full EP. The OPEP outlines responsibilities, specific procedures and identifies resources available in the unlikely event of an oil pollution incident. BHP maintains a constant vigilance and readiness to prevent and/or respond to hydrocarbon loss of containment incidents. The readiness and competency of BHP to respond to incidents is maintained and tested by conducting activity-specific emergency response exercises.

Should you have any questions, concerns or grievances regarding these activities or any other BHP Petroleum activities, please call BHP WA Community Hotline on **1800 421 077** or send an email to **bhppetexternalaffairs@bhp.com**

BHP believes in putting health and safety first, being environmentally responsible and supporting our communities.

Appendix E. Decommissioning Alternatives Environmental Impact Assessment



Decommissioning Alternatives Environmental Impact Assessment

Stybarrow Field

Woodside

25 July 2022

411012-00432

Advisian
Worley Group

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PROJECT 411012-00432 - 2200-REP-0001: Decommissioning Alternatives Environmental Impact Assessment - Stybarrow Field

Rev	Description	Author	Review	Advisian approval	Revision date	Client approval	Approval date
A	Draft for review	W. Chisholm	S. Dell	M. Western	22.06.22		
B	Draft for review	W. Chisholm	S. Dell	p.p. M. Western	07.07.22		
0	Issued for use	W. Chisholm	W. Chisholm	p.p. M. Western	25.07.22		

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Executive summary

Woodside has removed, or is planning to remove, most of the equipment in the Stybarrow Field. Woodside are proposing the following equipment groups as candidates for abandonment *in situ*:

- DTM anchors
- Suction piles associated with:
  - Nine riser bases
  - One water injection manifold foundation
- Wellheads:
  - One wellhead, Eskdale-1, where previous attempts to remove the wellhead were unsuccessful
  - A contingency for up to ten additional wellheads in the event that they cannot be removed following reasonable attempts to recover them.

In accordance with NOPSEMA's *Section 572 Maintenance and Removal of Property* (2020) policy, Woodside identified two feasible decommissioning alternatives for the equipment groups listed above:

- Full removal
- Abandonment *in situ*

The implementation of these alternatives assumes controls are implemented to manage environmental impacts and risks that are consistent with industry good practice.

The *Section 572 Maintenance and Removal of Property* (NOPSEMA, 2020) policy requires that Woodside evaluate the environmental impacts and risks of the feasible decommissioning alternatives listed above. Woodside did this by undertaking a decommissioning alternatives environmental impact assessment (EIA). The EIA used the analytic hierarchy process (AHP). An AHP analysis was developed for both equipment groups to determine the relative impacts of each of the feasible decommissioning alternatives on environmental values and sensitivities that may credibly be impacted.

The EIA considered the environmental impacts of the feasible decommissioning alternatives on the following environmental receptors:

- Sediment quality
- Water quality
- Benthic habitats
- Marine fauna
- Greenhouse gasses
- Onshore environmental receptors
- Other users

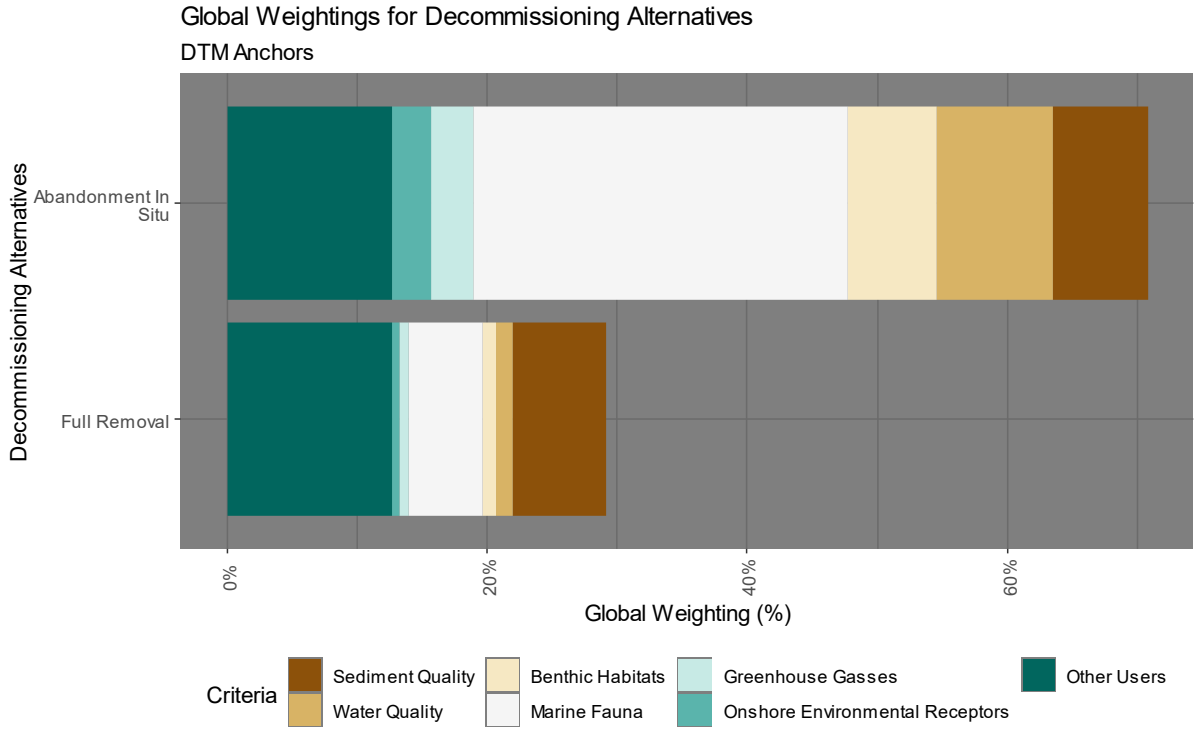
The EIA determined the relative weightings for each of these environmental receptors. Then the EIA compared the environmental performance of the feasible decommissioning options for each equipment group within each of these environmental receptors. The EIA did not explicitly consider risks (i.e., impacts that may occur due to accidents or emergencies) to environmental values and sensitivities.

The abandonment *in situ* alternative was the most preferred alternative for all equipment groups when assessed within the environmental receptors considered. Important considerations in the EIA that contribute to this result include:

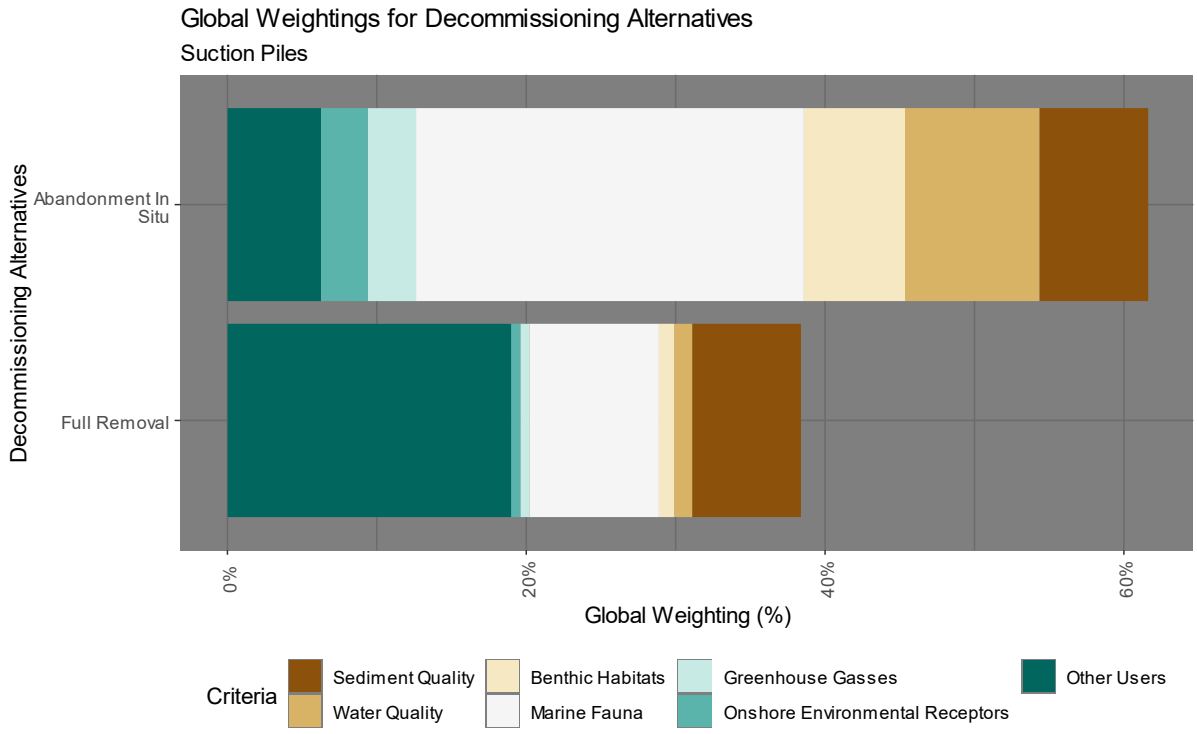
- candidate equipment groups being deeply embedded in the seabed and requiring substantial seabed disturbance to recover

- materials in the candidate equipment groups will result in negligible environmental impacts as they degrade *in situ*
- the risk of interactions between the candidate equipment groups and trawled fishing gear is negligible
- activities by other users of the sea in the Stybarrow field that may interact with the equipment have not historically occurred.

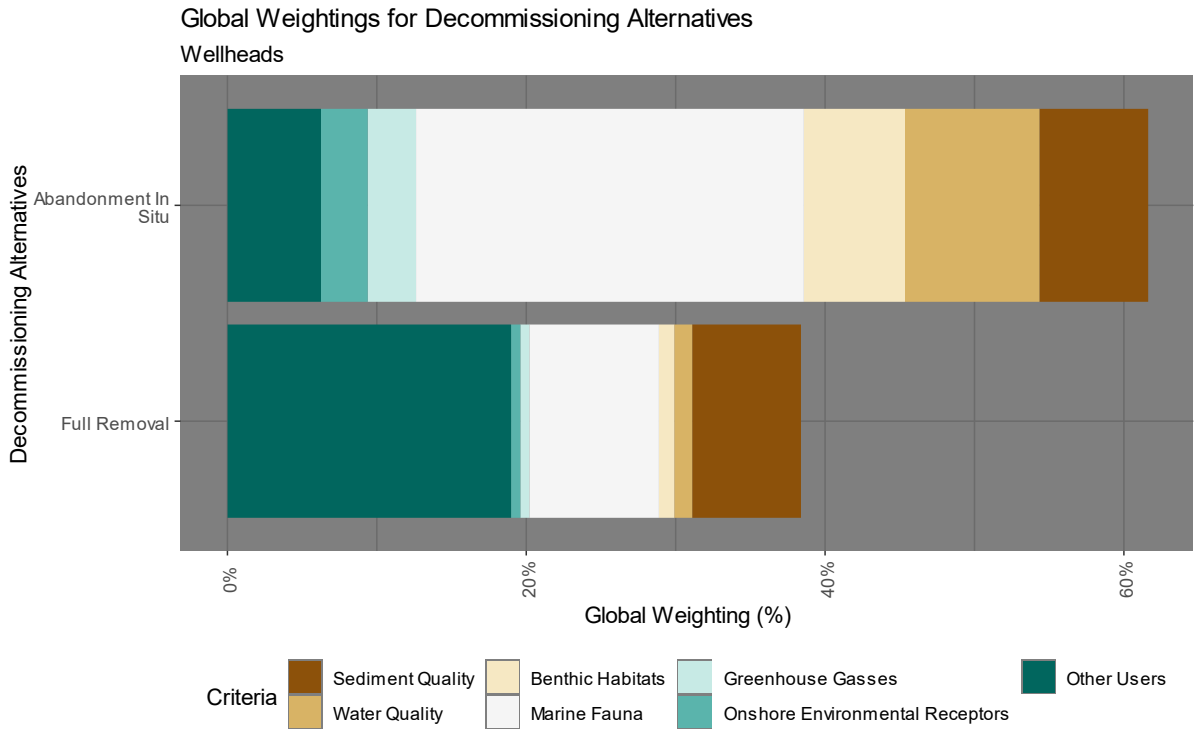
Summary results of the relative weightings for the feasible alternatives for the DTM anchor, suction piles and wellheads are shown in Executive Summary Figure 1 and Executive Summary Figure 2. The demonstration in the decommissioning alternatives EIA satisfies the requirement in the *Section 572 Maintenance and Removal of Property* (NOPSEMA, 2020) policy that any alternatives to full removal must result in equal or better environmental outcomes compared to full removal.



Executive Summary Figure 1: Stacked bar plot of global preference of the decommissioning alternatives for the DTM anchors



Executive Summary Figure 2: Stacked bar plot of global preference of the decommissioning alternatives for the suction piles



Executive Summary Figure 3: Stacked bar plot of global preference of the decommissioning alternatives for the wellheads

Acronyms and abbreviations

Acronym/abbreviation	Definition
AHP	Analytic Hierarchy Process
AWJ	Abrasive water jet
BHP	BHP Petroleum (Australia) Pty. Ltd.
BIA	Biologically Important Area
CI	Consistency Index
CO_2	Carbon dioxide
CR	Consistency Ratio
DC	Drill Centre
DTM	Disconnectable Turret Mooring
EIA	Environmental Impact Assessment
Environment Regulations	Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2009
EP	Environment Plan
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999*
FPSO	Floating Production, Storage and Offloading
GDA94	Geodetic Datum of Australia 1994
KEF	Key Ecological Feature
MCDA	Multi-criteria Decision Analysis
MGA50	Map Grid of Australia Zone 50
NOPSEMA	National Offshore Petroleum Safety and Environmental Management Authority
OPGGS Act	*Offshore Petroleum and Greenhouse Gas Storage Act 2006*
RI	Random Index
ROV	Remotely Operated Vehicle
Woodside	Woodside Energy Ltd.

1 Introduction

Woodside Energy Ltd. (Woodside), through its merger with BHP Petroleum (Australia) Pty. Ltd. (BHP), is the titleholder and operator of production licences WA-32-L, which cover the Stybarrow field. When in production, the Stybarrow field comprised the MV16 Stybarrow Venture, a floating production, storage, and offloading (FPSO) vessel, with production, gas injection and water injection wells at four drill centres routed to the disconnectable turret mooring (DTM) via flexible flowlines (Figure 1-1). Oil products were stabilised and stored for offloading via tanker.

The Stybarrow field ceased production in June 2015. Since then, the following cessation activities have been completed:

- all flowlines and gas lift lines were flushed and filled with treated seawater and production flowlines disconnected.
- all production, gas injection and water injection wells were shut in and capped to await plugging and abandonment.
- the Stybarrow Venture FPSO was disconnected from the DTM and demobilised from the field.

The DTM unexpectedly sunk to the seabed at some point between May 2016 and October 2016, where it lies in approximately 825 m water depth with risers still attached. Following the DTM sinking, the riser buoyancy modules were removed to eliminate any buoyant risk.

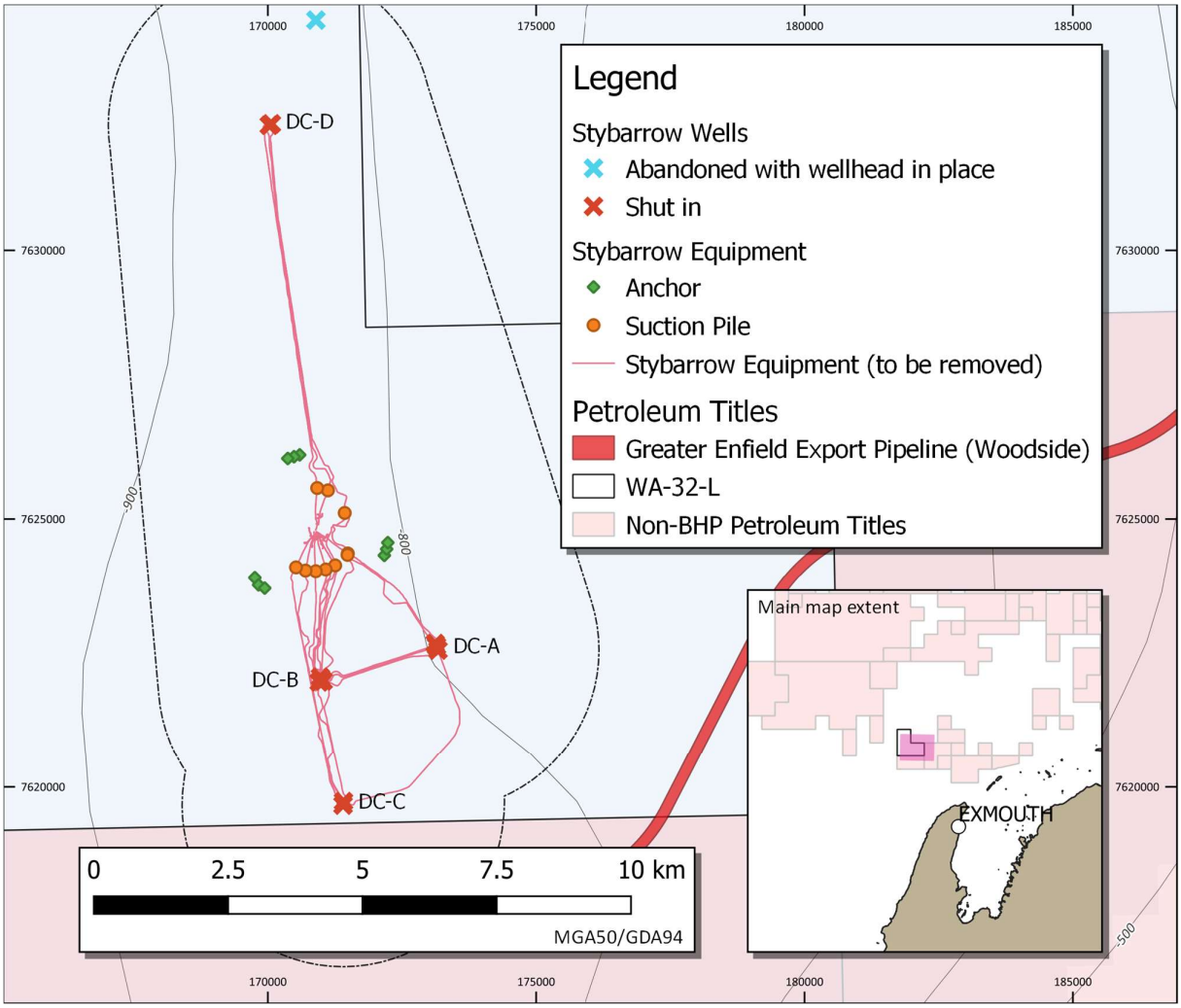


Figure 1-1: Overview of the Stybarrow field

Woodside is preparing to decommission the remaining equipment in WA-32-L. Section 572 of the Offshore Petroleum and Greenhouse Gas Storage Act 2006 (OPGGS Act) requires Woodside to remove equipment used for petroleum activities when it is no longer in use, such as following cessation of production. The National Offshore Petroleum Safety and Environmental Management Authority's (NOPSEMA's) *Section 572 Maintenance and Removal of Property* (2020) policy provides for alternative arrangements to the full removal of equipment to be accepted under the Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2009 (the Environment Regulations) on the conditions that:

- the Environment Plan (EP) detailing the alternative arrangements meets the criteria for acceptance under the Environment Regulations
- the EP demonstrates that the alternative arrangements are expected to result in equal, or better, environmental outcomes compared to the removal of equipment.

Woodside's philosophy for decommissioning of the equipment in the Stybarrow field is to remove predominantly plastic items, wellheads[1], and smaller, easily recovered items. This philosophy is aligned with the requirements in *Section 572 Maintenance and Removal of Property* (NOPSEMA, 2020). Woodside undertook preliminary screening of the equipment to identify equipment that may be inconsistent with this philosophy.

[1] If wellheads cannot be removed by reasonable attempts, they will be abandoned *in situ*.

Woodside has identified that alternatives to full removal, such as abandonment *in situ*, may yield equal or better environmental outcomes for two equipment groups in the Stybarrow field:

- nine disconnectable turret mooring (DTM) anchors.
- suction piles associated with:
  - nine riser bases (used to hold the risers in place)
  - one water injection manifold foundation.
- Wellheads:
  - One wellhead, Eskdale-1, where previous attempts to remove the wellhead were unsuccessful
  - A contingency for up to ten wellheads in the event that they cannot be removed following reasonable attempts to recover them.

With the exception of the Eskdale-1 exploration well, Woodside intends to remove all wellheads and is confident that the removal methodologies will be successful. As such, abandonment *in situ* of wellheads (aside from Eskdale-1) is a contingency activity only.

As required by the *Section 572 Maintenance and Removal of Property* (NOPSEMA, 2020) policy, this document compares the environmental outcomes of the feasible decommissioning alternatives for these equipment groups to determine their relative environmental outcomes. These outcomes were determined by an environmental impact assessment of the feasible decommissioning alternatives for the two equipment groups.

All other equipment within the Stybarrow field will be removed.

1.1 Offshore Decommissioning Environmental Policy and Legislative Context

The *Section 572 Maintenance and Removal of Property* (NOPSEMA, 2020) policy outlines NOPSEMA's interpretations of the application of Section 572 of the OPGGS Act and subsidiary regulations to decommissioning of offshore petroleum equipment. The following parts of the *Section 572 Maintenance and Removal of Property* (NOPSEMA, 2020) policy are relevant to the decommissioning of the equipment groups that are candidates for abandonment *in situ*, each of which is considered below:

- removal of property (Section 1.1.1), and
- deviations from the requirements to maintain and remove property (Section 1.1.2).

1.1.1 Removal of Property

The *Section 572 Maintenance and Removal of Property* (NOPSEMA, 2020) policy cites the requirements in Section 572(3) of the OPGGS Act for titleholders to remove property that is not used, or will not be used. This is the "base case" for decommissioning expressed in several of the publications that preceded the policy, such as the Offshore Petroleum Decommissioning Guideline (Commonwealth of Australia, 2018). The policy states:

"*Deviations from the property removal requirement of Section 572 may be agreed to by NOPSEMA through permissioning documents. A deviation in the context of this regulatory policy includes where a titleholder intends to do something that is different from the requirement of section 572(3).*"

This prompted Woodside to assess alternative options to the base case of full removal. The draft *Section 270 NOPSEMA Advice – Consent to Surrender Title* (NOPSEMA, 2021) indicates that permissioning documents include EPs, safety cases and well operations management plans.

The *Section 572 Maintenance and Removal of Property* (NOPSEMA, 2020) policy outlines the principles NOPSEMA applies when considering removal of property:

- Complete removal of all property is the base case for all offshore operations and should inform the basis for field development planning.
- All property is to be designed, installed, and operated to ensure it can be removed when it is neither used, nor to be used, unless a deviation is provided for in a permissioning document approved by NOPSEMA.
- Removal should be planned and undertaken throughout the operations authorised by the title when property is neither used, nor to be used.
- Complete removal of property must be completed while the title is still in force unless a deviation from the complete property removal requirement has been approved by NOPSEMA.
- NOPSEMA's acceptance of the activities associated with removal of property is obtained under the Environment Regulations and the Offshore Petroleum and Greenhouse Gas Storage (Resource Management and Administration) Regulations 2011.
- Where titleholders engage contractors to operate facilities, titleholders remain ultimately responsible for ensuring that adequate provisions including assurance and oversight are in place to meet the property removal requirements on titleholders.

1.1.2 Deviations from the Requirements to Maintain and to Remove Property

NOPSEMA recognises that removal of property may not always be practicable. NOPSEMA's *Section 572 Maintenance and Removal of Property* (2020) policy states that NOPSEMA must be reasonably satisfied that an EP proposing alternative arrangements meets the acceptance criteria in the Environment Regulations. NOPSEMA must also have regard to the *Guideline: Offshore Petroleum Decommissioning* (Department of Industry, Science, Energy and Resources, 2022), including titleholder demonstrations that the proposed alternative arrangements provide for equal or better environmental outcomes. The policy subsequently states the EP must include:

- an evaluation of the feasibility of all alternatives, including partial and complete property removal.
- an evaluation of environmental impacts and risks of all feasible alternatives, including complete property removal. This is required to enable NOPSEMA to have regard to the *Guideline: Offshore Petroleum Decommissioning* (Department of Industry, Science, Energy and Resources, 2022) policy principle that deviations will provide an equal or better environmental outcome when compared to complete property removal. The evaluation of all the environmental impacts and risks of each alternative must include consideration of control measures necessary to manage the impacts and risks.
- an evaluation of all environmental impacts and risks within Australia's environment including, where relevant, indirect consequences that may arise from the petroleum activity of removing property from a title area.
- arrangements addressing long term monitoring and management where deviation/s to removal of property or relocation of property is proposed. EPs requiring long-term monitoring for property will be subject to environmental performance reporting requirements and compliance monitoring by NOPSEMA for the duration of the monitoring program. NOPSEMA advises the Joint Authority of EPs requiring long term monitoring for property and this may be a matter taken into account when considering surrender of titles.
- consideration of relevant persons' consultation with respect to the alternatives being proposed.

The policy states that multi-criteria decision analysis (MCDA) may be used in an EP but notes that unless the information from the MCDA can be applied directly to the acceptance criteria of the Environment Regulations the EP is unlikely to demonstrate that the regulatory criteria for acceptance have been met.

2 Abandonment *In Situ* Candidate Equipment Groups

2.1 DTM Anchors

The DTM mooring anchors are embedment-style anchors and are securely lodged in the seabed. Each anchor consists of flukes, a shank and a pad eye made of steel, and is coated in paint (Figure 2-1). Each anchor weighs approximately 11 tonnes. The positions of the anchors are provided in Table 2-1 and shown in Figure 1-1.

The mooring lines from the DTM to the anchors will be fully removed under the Stybarrow Decommissioning and Field Management EP (BHPB-00SC-N000-003).

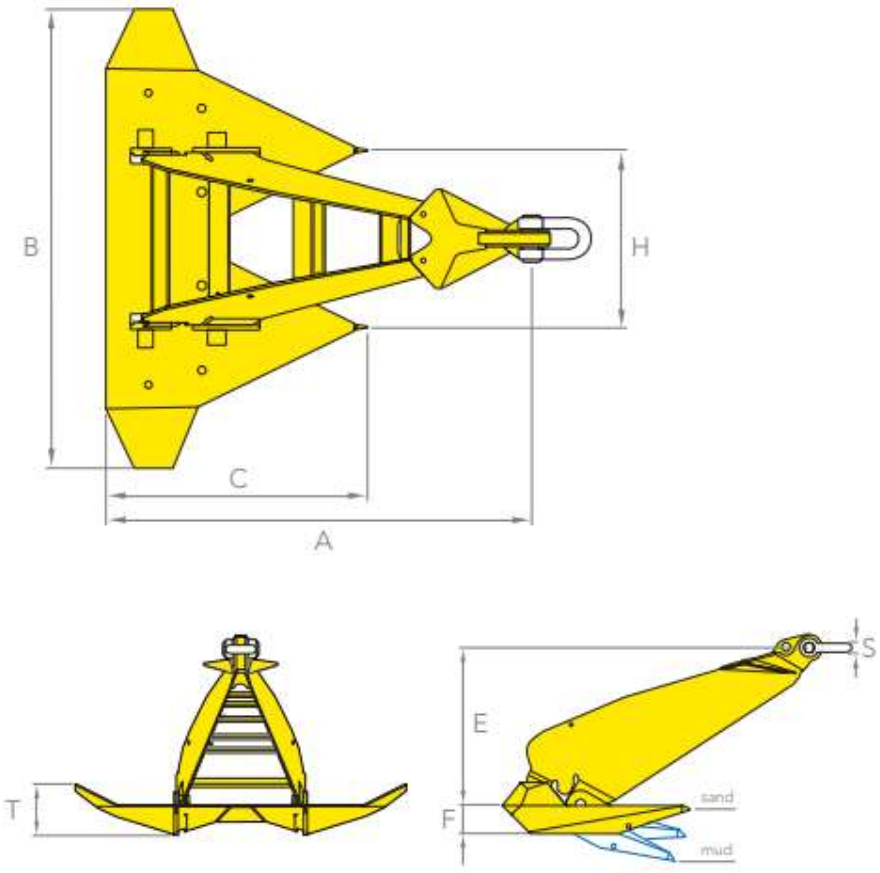


Figure 2-1: Design of embedment anchors (Stevpris) used in the Stybarrow field

Table 2-1: Anchor positions and depths (eastings and northings in MGA50/GDA94)

Mooring Leg Components	Easting (m)	Northing (m)	Depth (m)
Mooring 1 Anchor	172172.4	7624323.5	807.3
Mooring 2 Anchor	172215.2	7624441.7	807.5
Mooring 3 Anchor	172237.1	7624561.1	807.6
Mooring 4 Anchor	170594.8	7626195.0	826.1
Mooring 5 Anchor	170489.2	7626161.1	829.1
Mooring 6 Anchor	170372.9	7626127.5	828.7
Mooring 7 Anchor	169759.4	7623909.3	842.4
Mooring 8 Anchor	169828.7	7623775.8	842.7
Mooring 9 Anchor	169943.1	7623715.9	842.0

2.1.1 Feasible Decommissioning Alternatives

Two feasible decommissioning alternatives were identified for the DTM anchors:

- Full removal of the anchors, with no part left on or in the seabed (Section 2.1.1.1).
- Abandonment *in situ*, with anchors left embedded in the seabed in their current state (Section 2.1.1.2)

2.1.1.1 Full Removal

Recovery of the anchors is assumed to be done by pulling the anchors free in the opposite direction to which they were installed. This is assumed to be done using an anchor handling tug. The anchors are deeply embedded in the seabed by design. Seabed intervention, such as mass flow excavation, may be required to free the anchors from the sediment. Removal of the anchors will result in substantial disruption of the seabed above, around and along the removal path of the anchors.

The anchors would be brought to shore following removal for disposal. Disposal is assumed to consist of removal of the paint coating and recycling of the scrap steel. The anchors may not be suitable for re-use due to degradation during deployment and the potential for damage during recovery.

The environmental aspects from the full removal alternative are summarised in Table 2-2.

Table 2-2: Environmental aspects from the DTM anchor full removal alternative

Aspect	Description
Atmospheric emissions from: • Vessels undertaking the removal activity • Transport and processing of recovered anchors	Primarily combustion emissions from the use of fuel (assumed to be marine or automotive diesel) from vessels. Results in the release of atmospheric pollutants such as carbon dioxide, carbon monoxide, and particulates. All emissions in accordance with relevant requirements, such as Marine Order 97 (Marine pollution prevention – air pollution) 2013.
Seabed disturbance from anchor removal	Estimated that 100's to 1,000's m^2 of seabed will be disturbed during removal of each anchor. Sediments will be resuspended during removal of the anchors.
Emissions and discharges from vessels: • Utilities • Ballast, bilge, and deck drainage	Routine emissions and discharges made in accordance with relevant requirements, such as: • Marine Order 91 (Marine pollution prevention – oil) 2014 • Marine Order 93 (Marine pollution prevention – noxious liquid substances) 2014 • Marine Order 94 (Marine pollution prevention – packaged harmful substances) 2014 • Marine Order 95 (Marine pollution prevention – garbage) 2013 • Marine Order 96 (Marine pollution prevention – sewage) 2013
Underwater noise emissions	Underwater noise emissions. Thrusters used to dynamically position vessels will be the highest intensity noise source. Other noise sources include ROV operations and machinery noise.
Light emissions	Artificial light emissions from vessels (navigation and deck lights) and ROV.
Waste management	The main source of waste material will be the anchors, which are assumed to be transported to shore, cleaned, and the steel recycled. Routine vessel operations will also generate waste that will be disposed of onshore.

2.1.1.2 Abandonment In Situ

Abandonment *in situ* of the DTM anchors consists of leaving the anchors *in situ* at the conclusion of the equipment removal activities. The anchor chains will be removed from the DTM anchors as close as practicable to the pad eye.

The environmental aspects from the abandonment *in situ* alternative are summarized in Table 2-2.

Table 2-3: Environmental aspects from the DTM anchor abandonment in situ alternative

Aspect	Description
Physical presence of the anchors in the seabed	The anchors will be left embedded in the seabed.. The locations of the anchors will be confirmed and communicated to relevant persons, including the Australian Hydrographic Office for inclusion on nautical charts.
Degradation of the anchors	Degradation of the anchors *in situ* releasing degradation products to the environment. Iron is the major component of the anchors, with trace amounts of carbon and alloying metals. The anchors have an epoxy paint coating, which will also be released to the environment as they degrade.

2.2 Suction Piles

A series of nine suction piles are installed in the seabed, to which the risers are attached by holdback clamps. Each of these suction piles is approximately 7 m long and 4 m in diameter (Figure 2-2). The suction piles that are securely embedded in the seabed. An additional suction pile is used as the foundation for the water injection manifold, which is approximately 7.83 m long and 6.42 m in diameter. All suction piles are made of low carbon steel, with trace amounts of alloying metals (Table 2-4). Each pile has sacrificial anodes and a paint coating on the upper part of the pile intended to reduce corrosion. The majority of the pile surface embedded in the seabed was not painted in order to enhance friction between the pile and the seabed, resulting in greater holding capacity.

The positions of the riser base and water injection manifold suction piles are shown in Table 2-5 and Figure 1-1. All equipment attached to the suction piles, such as riser holdback clamps and the water injection manifold, will be removed prior to abandonment *in situ*.

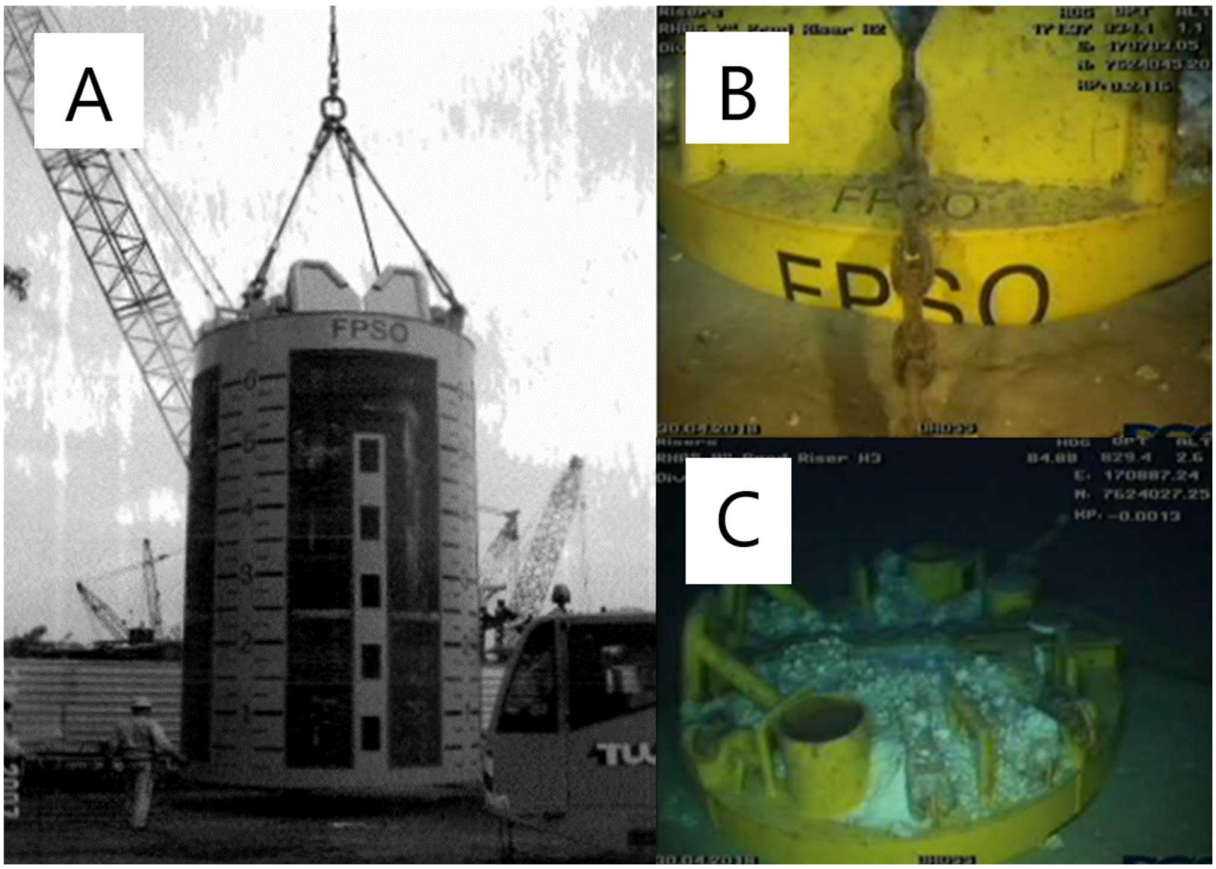


Figure 2-2: A riser holdback anchor suction pile prior to installation (A) and embedded in the seabed (B and C)

Table 2-4: Indicative percentage composition of alloying materials in suction pile low carbon steel

Alloying Material	Percentage Composition (%)
Manganese	1.23
Cerium	0.42
Silicon	0.25
Carbon	0.18
Copper	0.14
Chromium	0.10
Nickel	0.06
Aluminium	0.052
Molybdenum	0.02
Phosphorus	0.018
Sulphur	0.017
Niobium	0.002
Titanium	0.002
Boron	0.0004
Vanadium	0.000

Table 2-5: Suction pile positions (eastings and northings in MGA50/GDA94)

Riser Bases	Easting	Northing
Dynamic Umbilical Riser Base	171433.8	7625113.9
Water Injection 10" Riser base	171491.8	7624359.1
H4GL Gas Lift 6" Riser Base	171256.2	7624136.9
EG1 Gas Injection 6" Riser Base	171121.0	7625533.9
H4 Production 8" Riser Base	171080.4	7624061.0
H3 Production 8" Riser Base	170894.3	7624028.6
H2 Production 7" Riser Base	170704.2	7624040.9
H1 Production 7" Riser Base	170526.5	7624100.2
EH1 Production 6" Riser Base	170921.2	7625578.0
Water Injection Manifold Suction Pile Foundation	171486.5	7624333.0

2.2.1 Feasible Decommissioning Alternatives

Two feasible decommissioning alternatives were identified for the suction piles:

- Full removal of the suction piles, with no part left on or in the seabed (Section 2.2.1.1)
- Abandonment *in situ*, with the piles left in the seabed in their current state (Section 2.2.1.2)

2.2.1.1 Full Removal

The suction piles installed for the riser holdback anchors and the water injection manifold were not designed to be removed; their purpose is to provide a secure anchor or foundation, which depends on their ability to remain securely embedded within the seabed.

The piles are assumed to be removed by attaching a recovery harness to the top of the pile and pressurising the internal space of the pile with high-pressure water supplied by a vessel-based pump. The harness and pressure line would be attached to the pile using an ROV. As the pressure within the pile increases, the recovery hardness is pulled upwards and recovered to a vessel. Recovery of the piles may also require sediment relocation to help loosen them. This is assumed to be done by an ROV with a sediment relocation tool, such as a mass flow excavator. Once free of the seabed, the piles will be recovered to a vessel for transport to shore, where each pile will be cleaned and disposed of by recycling and landfill.

The environmental aspects from the full removal alternative are summarised in Table 2-6.

Table 2-6: Environmental aspects from the suction piles full removal alternative

Aspect	Description
Atmospheric emissions from: • Vessels undertaking the removal activity • Transport and processing of recovered piles	Primarily combustion emissions from the use of fuel (assumed to be marine or automotive diesel) from vessels. Results in the release of atmospheric pollutants such as carbon dioxide, carbon monoxide, and particulates. All emissions in accordance with relevant requirements, such as Marine Order 97 (Marine pollution prevention – air pollution).
Seabed disturbance from pile removal	Estimated that 10s-100s m^2 will be disturbed during removal of each pile.
Emissions and discharges from vessels: • Utilities • Ballast, bilge, and deck drainage	Routine emissions and discharges made in accordance with relevant requirements, such as: • Marine Order 91 (Marine pollution prevention – oil) 2014 • Marine Order 93 (Marine pollution prevention – noxious liquid substances) 2014 • Marine Order 94 (Marine pollution prevention – packaged harmful substances) 2014 • Marine Order 95 (Marine pollution prevention – garbage) 2013 • Marine Order 96 (Marine pollution prevention – sewage) 2013
Underwater noise emissions	Underwater noise emissions. Thrusters used to dynamically position vessels will be the highest intensity noise source. Other noise sources include ROV operations and machinery noise.
Light emissions	Artificial light emissions from vessels (navigation and deck lights) and ROV.
Waste management	The main source of waste material will be the suction piles, which are assumed to be transported to shore, cleaned, and the steel recycled. Routine vessel operations will also generate waste that will be disposed of onshore.

2.2.1.2 Abandonment In Situ

Abandonment *in situ* of the suction piles consists of leaving the piles *in situ* at the conclusion of the equipment removal activities. Any attachments to the piles will be removed as close as practicable to the pile. The tops of the piles are assumed to be at or slightly above the seabed.

The environmental aspects from the abandonment *in situ* alternative are summarised in Table 2-7.

Table 2-7: Environmental aspects from the suction piles abandonment in situ alternative

Aspect	Description
Physical presence of the piles in the seabed	The suction piles will be left embedded in the seabed. The locations of the piles will be confirmed and communicated to relevant persons, including the Australian Hydrographic Office for inclusion on nautical charts.
Degradation of the piles	Degradation of the suction piles *in situ* releasing degradation products to the environment. Iron is the major component of the piles, with trace amounts of carbon and alloying metals. The piles have a paint coating, which will also be released to the environment as they degrade.

2.3 Wellheads

The wellheads are comprised of mild steel and may contain small quantities of synthetic materials (e.g., Teflon) within the seal component. Surface coatings have been used on the wellheads for corrosion protection. The wellheads typically extend between 2 m and 3 m above the mudline to facilitate installation of guide bases, blowout preventers and Christmas trees.

The Eskdale-1 exploration well was drilled by BHP in 2003 and did not encounter commercially viable accumulations of hydrocarbons. The well was subsequently successfully plugged and abandoned at the conclusion of the drilling program. The rig cut and attempted to recover the wellhead; repeated attempts were unsuccessful. BHP subsequently informed the Western Australian Department of Industry and Resources (the administrator of the petroleum title at the time) that recovery of the wellhead was not feasible, and that BHP intended to abandon the wellhead *in situ*. The release of fluids from the Eskdale-1 well below the cement plugs installed during plug and abandonment is not credible. The Eskdale-1 wellhead is uncapped.

All other wellheads (excluding Eskdale-1) that may be abandoned *in situ* are shut in production wells with Christmas trees in place, providing a barrier between the well and the environment. Woodside will remove the trees and wellheads either during plug and abandonment or equipment removal activities. Woodside has substantial experience in wellhead removal and is confident that these wellheads can be successfully removed below the mudline. However, Woodside has identified abandonment *in situ* as a contingency decommissioning option, hence it is considered within the decommissioning alternatives environmental impact assessment.

The wells within the scope of the assessment are listed in Table 2-8 and shown in Figure 1-1.

Table 2-8: Well positions (eastings and northings in MGA50/GDA94)

Drill Centre	Well	Easting (m)	Northing (m)
N/A	Eskdale-1	170896.58	7634287.20
DC-A	Stybarrow-5 (I-3) Well	173119.00	7622683.90
	Stybarrow-6 (I-2) Well	173143.86	7622636.19
	Stybarrow-12 (H-5) Well	173172.80	7622560.74
DC-B	Stybarrow-9 (I-1) Well	171032.33	7621985.59
	Stybarrow-10 (H-3) Well	170958.06	7621964.06
	Stybarrow-11 (H-4) Well	170980.53	7622056.34

Drill Centre	Well	Easting (m)	Northing (m)
DC-C	Stybarrow-7 (H-2) Well	171413.34	7619728.58
	Stybarrow-8 (H-1) Well	171403.11	7619659.88
DC-D	Eskdale-3 (EH1) Well	170065.05	7632345.32
	Eskdale-4 (EG1) Well	170024.53	7632318.26

2.3.1 Feasible Decommissioning Alternatives

Two feasible decommissioning alternatives were identified for the suction piles:

- Full removal of the suction piles, with no part left on or in the seabed (Section 2.2.1.1)
- Abandonment in situ, with the piles left in the seabed in their current state (Section 2.2.1.2)

2.3.1.1 Full Removal

Full removal of the wellheads consists of cutting the wellhead and recovering the section of the wellhead above the cut from the seabed. The cut is expected to be made using a mechanical cutting tool or an abrasive water jet (AWJ) tool inserted into the wellhead. The decommissioning alternatives environmental impact assessment assumed the AWJ method has been used.

Once the cut is completed, the wellhead will be recovered from the seabed and transported to shore for disposal (assumed to be scrap metal). Recovered wellheads are not suitable for reuse or repurposing.

The environmental aspects from the full removal alternative are summarised in Table 2-9.

Table 2-9: Environmental aspects from the wellhead full removal alternative

Aspect	Description
Atmospheric emissions from: • Vessels undertaking the removal activity • Transport and processing of recovered wellheads	Primarily combustion emissions from the use of fuel (assumed to be marine or automotive diesel) from vessels. Results in the release of atmospheric pollutants such as carbon dioxide, carbon monoxide, and particulates. All emissions in accordance with relevant requirements, such as Marine Order 97 (Marine pollution prevention – air pollution).
Seabed disturbance from wellhead removal	Estimated that 10s m^2 will be disturbed during removal of each pile.
Emissions and discharges from: • Vessel utilities • Vessel ballast, bilge, and deck drainage • Cutting fluids from abrasive water jet cutting • Swarf from wellhead cutting	Routine vessel emissions and discharges made in accordance with relevant requirements, such as: • Marine Order 91 (Marine pollution prevention – oil) 2014 • Marine Order 93 (Marine pollution prevention – noxious liquid substances) 2014 • Marine Order 94 (Marine pollution prevention – packaged harmful substances) 2014 • Marine Order 95 (Marine pollution prevention – garbage) 2013 • Marine Order 96 (Marine pollution prevention – sewage) 2013 Abrasive water jet cutting will release high pressure water and the abrasive grit to the environment (approximately 4 t of grit per well). The grit and swarf will mostly fall within the well.
Underwater noise emissions	Underwater noise emissions. Thrusters used to dynamically position vessels will be the highest intensity noise source. Other noise sources include ROV operations, cutting tools and machinery noise.
Light emissions	Artificial light emissions from vessels (navigation and deck lights) and ROV.
Waste management	The main source of waste material will be the wellheads, which are assumed to be transported to shore, cleaned, and the steel recycled. Routine vessel operations will also generate waste that will be disposed of onshore.

2.3.1.2 Abandonment In Situ

Abandonment *in situ* decommissioning alternative consists of leaving the wellheads *in situ* at the conclusion of the equipment removal activities. Any guide bases or Christmas trees attached to the wellheads will be recovered as part of an equipment removal campaign.

The environmental aspects from the abandonment *in situ* alternative are summarised in Table 2-10.

Table 2-10: Environmental aspects from the wellhead abandonment in situ alternative

Aspect	Description
Physical presence of the wellheads in the seabed	The wellheads will be left embedded in the seabed, with approximately 2 to 3 m extending above the mudline. The locations of the wellheads will be confirmed and communicated to relevant persons, including the Australian Hydrographic Office for inclusion on nautical charts.
Degradation of the wellheads	Degradation of the wellheads *in situ* releasing degradation products to the environment. Iron is the major component of the mild steel from which the wellheads are made, with trace amounts of carbon and alloying metals. The wellheads have a paint coating, which will also be released to the environment as they degrade.

3 Comparative Assessment Methodology

A comparative impact assessment of the environmental impacts of the feasible decommissioning options was undertaken using the analytic hierarchy process (AHP) for the equipment groups identified in Section 2. AHP is a multi-criteria decision analysis (MCDA) method, where the alternatives can be compared using a suite of criteria. The AHP method has been studied extensively in a range of disciplines (e.g., defence, finance, and medicine) and is supported by a wide body of literature. The comparative assessment methodology is available in more detail in Saaty (1996). A concise description of the AHP in the context of environmental impact assessment has been provided by Ramanathan (2001).

Determining the relative environmental outcomes of the feasible options for the equipment groups is a complex process that requires consideration of many factors. The AHP facilitates this by identifying these factors and making determinations about each independently. Once each of these smaller determinations has been made, they are then aggregated into a holistic summary of all the deliberations made. To facilitate the comparative assessment, each comparative impact assessment was composed into a hierarchy comprising the following elements:

- the statement of the goal,
- the environmental criteria, and
- the feasible alternatives to be considered for each equipment group.

A conceptual model of an AHP hierarchy with these elements is shown in Figure 3-1.

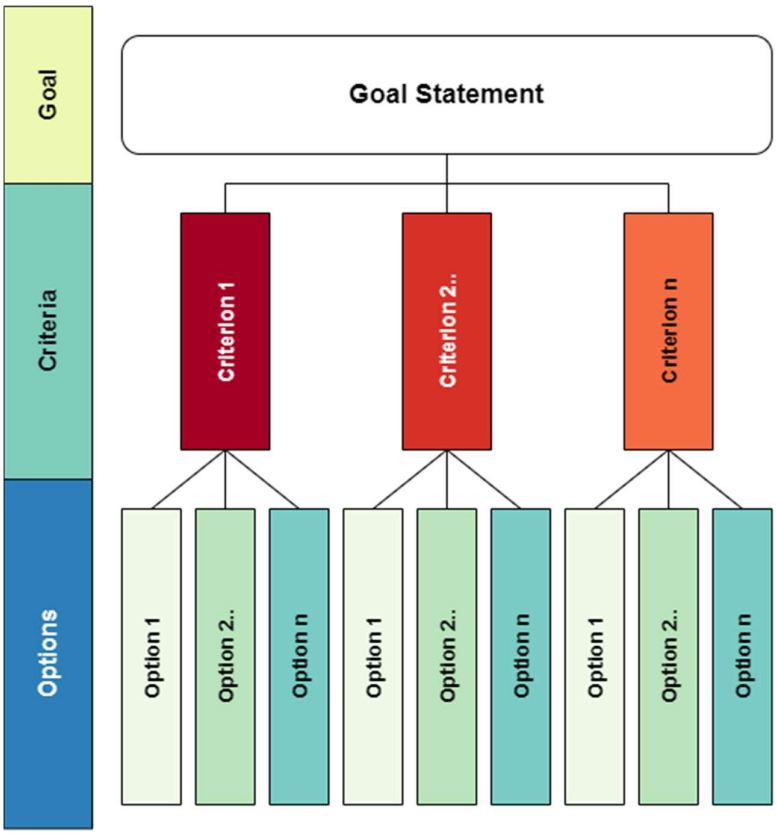


Figure 3-1: Conceptual AHP hierarchy showing goal statement, criteria, and options to achieve the goal

3.1 Define the Goal

The AHP commenced with the formulation of a goal statement. The goal statement is the root of the AHP hierarchy. A goal statement was formulated for each equipment group, which take the form shown below:

"*Determine the relative environmental outcomes of the feasible decommissioning options for the [EQUIPMENT GROUP]*"

Where [EQUIPMENT GROUP] is the equipment group being considered in the AHP. Hierarchy diagrams for each equipment group are provided in Section 5.

The goal statements encompass the requirement of *Section 572 Maintenance and Removal of Property* (NOPSEMA 2020) policy that any proposed deviation from the decommissioning base case of full removal of equipment is demonstrated to result in equal or better environmental outcomes. By structuring the comparative assessment around this goal, Woodside has compared the environmental outcomes for all the feasible decommissioning options that were considered.

3.2 Identify the Feasible Options

Woodside identified the feasible decommissioning alternatives for the candidate equipment groups. Feasible decommissioning alternatives for each of the candidate equipment groups was broadly categorised as:

- Full removal of the equipment, with no part of the equipment left on or in the seabed.
- Abandonment *in situ*, with all the equipment left on the seabed in its current state

The feasible alternatives for each equipment group are summarised in Table 3-1.

Table 3-1: Summary of feasible decommissioning alternatives for the candidate equipment groups

Equipment Group	Full Removal	Abandonment *In Situ*
DTM anchors	Feasible	Feasible
Suction piles	Feasible	Feasible
Wellheads	Feasible	Feasible

These alternatives were identified by Woodside through:

- a review of relevant requirements, particularly the *Section 572 Maintenance and Removal of Property* (NOPSEMA, 2020) policy, which requires titleholders proposing alternatives to full removal to:
  - evaluate the feasibility of all alternatives, including partial and complete removal of property
  - evaluate the environmental impacts and risks of all feasible alternatives, including complete removal, to demonstrate that the alternative yields equal or better environmental outcomes than full removal.
- a review of offshore decommissioning activities globally
- feedback received during stakeholder engagement and a stakeholder workshop
- preliminary engineering consideration of the methods by which an alternative may be implemented
- preliminary assessment of the acceptability of the alternatives.

Partial removal of the water injection manifold foundation suction pile and wellheads (i.e., cutting the pile or wellhead above the seabed) was not considered to be feasible because the complexity was far greater than any environmental benefit. The cut would require a large diameter diamond wire cutter and would result in a similar level of seabed disturbance to the full removal option. The pile and wellheads extend approximately 0.8 m and between 2 to 3 m above the seabed respectively, and the performance of a partial removal cut would result in negligible reduction of the section extending above the seabed.

Methods to implement each of these alternatives are described in Section 2. These descriptions are based on a "concept select" engineering basis. Implementation of any of the feasible alternatives would require more detailed engineering analysis and refinement than what is presented in this report. However, the methods presented are sufficient to inform the environmental impact assessments for the feasible decommissioning alternatives.

Methods that clearly had unacceptable impacts and risks to the environment, or could be substituted with less hazardous alternatives, were not considered. This ensures that the decommissioning alternatives environmental impact assessments were not unduly biased against any of the alternatives. The methods presented for each equipment group are reasonable and consistent with contemporary offshore engineering practices.

3.3 Identify the Criteria

Given the comparative impact assessment is intended to demonstrate the relative environmental outcomes of the feasible option, the criteria in the AHP were based on the environmental receptors that could credibly be impacted by the feasible options. Environmental receptors considered in the comparative impact assessments were identified based on the nature and scale of the aspects of each feasible option.

Each environmental receptor identified as a criterion was assessed to determine if the receptor warranted decomposition into sub-criteria. The decision to break down a criterion further into sub-criteria considered:

- whether the sub-criteria differed in their scale, environmental value, and vulnerability to impacts,
- whether the sub-criteria could reasonably be impacted by the decommissioning alternatives in different ways,
- whether the sub-criteria had specific relevant requirements that warranted consideration to meet the needs of Environment Regulations.

None of the environmental receptors warranted decomposition into sub-criteria.

No consideration was made for the environmental receptors that may credibly be at risk of impacts from unplanned events.

The environmental receptors identified as criteria in the AHP hierarchy were compared to determine the relative priority (i.e., weighting) each should receive using the process outlined below in Section 3.4. The relative environmental value of each criterion was determined by considering the:

- value placed on the criterion by legislation (which is intended to protect extrinsic and intrinsic value of the environmental receptor), cultural value, economic value, recreational value.
- value placed on it because it supports other environmental values –the "connectedness" of the receptor.
- uniqueness of the environmental value within the environment.

3.4 Pairwise Comparison of Criteria and Options

Following construction of the AHP hierarchy, all possible pairwise[2] comparisons were made between the child nodes below the goal and the criteria nodes in the hierarchy. These pairwise comparisons were used to determine the local and global priority for each of the nodes below the goal in the hierarchy.

[2] Pairwise comparison generally is any process of comparing entities in pairs to judge which of each entity is preferred, or has a greater amount of some quantitative property, or whether or not the two entities are identical.

The pairwise comparisons for goal and criteria nodes in the AHP were documented in a square matrix (A) of dimensions n by n, where n are the criteria or options being compared:

$$A = \begin{bmatrix} a_{11} & a_{12} & \dots & a_{1n} \\ a_{21} & a_{22} & \dots & a_{2n} \\ a_{31} & a_{32} & \dots & \dots \\ a_{n1} & a_{n2} & \dots & a_{nn} \end{bmatrix}$$

The comparisons between criteria and options were made based on their relative importance or preference to achieving the goal. The comparison ratings and definitions are listed in Table 3-2.

Deliberations on pairwise comparisons considered the relative merits of the items being compared. The comparisons within each node of the hierarchy were limited to the scope of the node. For example:

- the comparisons within the goal criterion only considered the relative importance of the criteria nodes.
- the comparisons of the decommissioning options within a criterion only considered the potential impacts of each option on that criterion.

Where a comparison of two criteria or alternatives within the judgment matrix was rated, the inverse comparison within the matrix was assigned the reciprocal value (e.g., if a comparison was assigned a value of 5/5, the inverse comparison was assigned the value of 1/5).

Comparisons were made by an experienced marine scientist, with consideration given to the nature and scale of each of the impacts to the criterion from each option, including spatial extent, temporal extent, and the intensity or magnitude of the impact. All comparisons were reviewed by environmental consultants and engineers familiar with the candidate equipment groups and the existing environment.

Once all pairwise comparisons had been made and the judgment matrix for a given element of the hierarchy was completed, the local priorities (i.e., the relative priority of the comparisons within the matrix) were estimated. The estimates were derived from the calculation of the normalised principal eigenvector and eigenvalues of the matrix.

Once calculated, local priorities of comparisons from all judgment matrices were aggregated to obtain the global priorities for each of the options within the hierarchy. This was done by summing the local priorities for each of the nodes within the hierarchy.

Table 3-2: Relative qualitative judgment criteria used for pairwise comparisons

Rating	Definition	Description
1	Equal importance/preference	Both elements are of equal importance
3	Moderate importance/preference	Experience and judgment slightly favour one element over the other
5	Strong importance/preference	Experience and judgment strongly favour one element over the other
7	Very strong importance/preference	One element is very strongly favoured over the other
9	Extreme importance/preference	The evidence favouring one element is of the highest possible order of affirmation

Source: Ramanathan (2001)

3.4.1 Comparison Consistency

The logical consistency of pairwise comparisons within a judgment matrix can be assessed by calculating the consistency ratio (CR). Reviewing the CR may indicate if the pairwise comparisons have any unexpected discrepancies that may warrant further assessment. The consistency of the comparisons within each

judgment matrix was assessed by calculating the consistency ratio (CR), which was defined by Ramanathan (2001) as:

$$CR = \frac{CI}{RI}$$

where CI and RI are called the consistency index and random index respectively.

CR values of ~10% or less are considered to indicate good agreement between the scores in each judgment matrix. CR values greater than ~10% may indicate internal disagreement within a judgment matrix for the applied ratings and may warrant further consideration.

CI was defined as:

$$CI = \frac{(\lambda_{max} - n)}{(n - 1)}$$

where λ_{max} is the largest value from the non-normalised principal eigenvector of the judgment matrix and n is the number of items being compared (i.e., the dimension of the matrix).

RI is the consistency index of a randomly generated judgment matrix from the scale in Table 3-2. Average RI values were determined by Saaty (2000) for randomly generated matrices using a bootstrapping method for a sample size of 500. RI's for judgment matrices up to n = 10 (i.e., sufficient to encompass all judgment matrices considered in this report) are provided in Table 3-3.

Table 3-3: RI values determined by Saaty (2000)

Number of Items being Compared	RI Value
3	0.58
4	0.9
5	1.12
6	1.24
7	1.32
8	1.41
9	1.45
10	1.49

4 Assessment of Environmental Receptors

4.1 Identification of Environmental Receptors

The following environmental receptors were identified using the process described in Section 3.3 and the environmental aspects of the feasible decommissioning alternatives for the candidate equipment groups (Section 2). The environmental receptors identified by the process described above comprise:

- Sediment quality
- Water quality
- Benthic habitats
- Marine fauna
- Greenhouse gasses
- Onshore environmental receptors
- Other users

Each of these environmental receptors is described below.

4.2 Descriptions of Environmental Receptors

4.2.1 Sediment Quality

Sampling by Cardno (2019) indicated that sediments within the Stybarrow field are characterised by silt-sized (3.9 mm to 62.5 µm) particles, which is typical of sediments in similar water depths in the region (Baker et al., 2008).

Analysis of potential contaminants in sediments indicated that concentrations of metals, radionuclides, and hydrocarbons within the Stybarrow field were generally not significantly higher than concentrations observed at reference sites. Elevated concentrations of some metals were observed at sites within the Stybarrow field – concentrations of lead, barium, boron, arsenic, and mercury were higher at some impacted sites within the field, although barium was the only metal in which concentrations between impact and reference sites was statistically significant (Cardno, 2019). Increased barium concentrations may be due to historical discharges of drilling fluids, which commonly contain barium sulphate (barite) as a weighting agent. Concentrations of lead, mercury and arsenic were above the default guideline values for sediment quality stated in the *Australian and New Zealand guidelines for Fresh and Marine Water Quality* (Commonwealth of Australia and New Zealand Government, 2018), although none exceeded the upper guideline values at which toxicity-related effects may be expected to be observed.

4.2.2 Water Quality

Cardno (2019) sampled surface waters in WA-32-L and found no evidence of contaminants. Given the depth of the equipment in the Stybarrow field, it is very unlikely that water from near the seabed would mix to the surface. The deeper parts of the water column below the thermocline are typically poorly mixed compared to surface waters and hence form an extensive barrier between water at the seabed and water at the surface.

4.2.3 Benthic Habitats

Cardno (2019) observed only unconsolidated sediment within WA-32-L, with no areas of hard substate (with the exception of the Stybarrow field equipment). Few epifauna and demersal or benthic fish were observed by Cardno (2019), which is consistent with similar deep-water habitats in the region, with heart urchins grenadier fish and decapods the most commonly observed taxa.

Infauna sampling by ROV cores yielded very few infauna at impact and control sites in WA-32-L, indicating low density but widely distributed infauna assemblages (Cardno, 2019). This is consistent with other surveys in the region (e.g., RPS, 2013).

An environmental survey and literature review of canyons in the region by BMT Oceanica (2016) concluded the following:

- The North and South Enfield Canyons are regarded as bathyal which is defined as 200-2,000 m, ~1% gravel, ~70% mud, ~ 5 °C temperature at the seabed, and a 1° slope.
- Typical benthic habitats within the neighbouring Enfield region was bare, unconsolidated, muddy, soft substrate and typically support sparse assemblages of filter and deposit-feeding epibenthic fauna.
- Outcropping rock and consolidated or coarser sediment habitats appeared to be minor components of the seabed.
- Distribution of biota was patchy, with crustaceans, molluscs, echinoderms, cnidarians and poriferans recorded. Motile scavengers were regarded as the dominant group including crabs and shrimps. Echinoderms were less abundant and consisted of ophiuroids, holothurians, echinoids and asteroids.

Two key ecological features (KEFs) occur within the Operational Area and are considered to be of regional importance for either a region's biodiversity or its ecosystem function and integrity:

- Continental Slope Demersal Fish Communities
- Canyons linking the Cuvier Abyssal Plain and the Cape Range Peninsula

4.2.4 Marine Fauna

There are a range of marine fauna that may occur in the vicinity of WA-32-L, including several species that are matters of national environmental significance under the EPBC Act (Table 4-1). There are several biologically important areas (BIAs) that overlap WA-32-L, including:

- Pygmy blue whale migration
- Pygmy blue whale distribution
- Wedge-tailed shearwater breeding

Table 4-1: Threatened and migratory species predicted to occur within WA-32-L

Value/Sensitivity Common Name	Scientific Name	Threatened Status	Migratory Status	Presence within Operational Area
Fish, Sharks and Rays				
Oceanic Whitetip Shark	*Carcharhinus longimanus*	-	Migratory	Species or species habitat may occur within area
White Shark, Great White Shark	*Carcharodon carcharias*	Vulnerable	Migratory	Species or species habitat may occur within area
Shortfin Mako, Mako Shark	*Isurus oxyrinchus*	-	Migratory	Species or species habitat likely to occur within area
Longfin Mako	*Isurus paucus*	-	Migratory	Species or species habitat likely to occur within area
Giant Manta Ray	*Mobula birostris*	-	Migratory	Species or species habitat likely to occur within area
Scalloped Hammerhead	*Sphyrna lewini*	Conservation Dependent	-	Species or species habitat may occur within area
Southern Bluefin Tuna	*Thunnus maccoyii*	Conservation Dependent	-	Species or species habitat likely to occur within area
Marine Mammals				
Antarctic Minke Whale, Dark-shoulder Minke Whale	*Balaenoptera bonaerensis*	-	Migratory	Species or species habitat likely to occur within area
Sei Whale	*Balaenoptera borealis*	Vulnerable	Migratory	Species or species habitat likely to occur within area
Bryde's Whale	*Balaenoptera edeni*	-	Migratory	Species or species habitat likely to occur within area
Blue Whale	*Balaenoptera musculus*	Endangered	Migratory	Migration route known to occur within area
Fin Whale	*Balaenoptera physalus*	Vulnerable	Migratory	Species or species habitat likely to occur within area
Southern Right Whale	*Eubalaena australis*	Endangered	Migratory[3]	Species or species habitat may occur within area
Humpback Whale	*Megaptera novaeangliae*	-	Migratory	Species or species habitat likely to occur within area
Killer Whale, Orca	*Orcinus orca*	-	Migratory	Species or species habitat may occur within area

[3] as *Balaena glacialis australis*

Value/Sensitivity Common Name	Scientific Name	Threatened Status	Migratory Status	Presence within Operational Area
Sperm Whale	*Physeter macrocephalus*	-	Migratory	Species or species habitat may occur within area
Spotted Bottlenose Dolphin (Arafura/Timor Sea populations)	*Tursiops aduncus* (Arafura/Timor Sea populations)	-	Migratory	Species or species habitat may occur within area
Marine Reptiles				
Loggerhead Turtle	*Caretta caretta*	Endangered	Migratory	Species or species habitat known to occur within area
Green Turtle	*Chelonia mydas*	Vulnerable	Migratory	Species or species habitat known to occur within area
Leatherback Turtle, Leathery Turtle, Luth	*Dermochelys coriacea*	Endangered	Migratory	Species or species habitat known to occur within area
Hawksbill Turtle	*Eretmochelys imbricata*	Vulnerable	Migratory	Species or species habitat known to occur within area
Flatback Turtle	*Natator depressus*	Vulnerable	Migratory	Species or species habitat known to occur within area
Birds				
Common Sandpiper	*Actitis hypoleucos*	-	Migratory	Species or species habitat may occur within area
Common Noddy	*Anous stolidus*	-	Migratory	Species or species habitat may occur within area
Sharp-tailed Sandpiper	*Calidris acuminata*	-	Migratory	Species or species habitat may occur within area
Red Knot, Knot	*Calidris canutus*	Endangered	Migratory	Species or species habitat may occur within area
Curlew Sandpiper	*Calidris ferruginea*	Critically Endangered	Migratory	Species or species habitat may occur within area
Pectoral Sandpiper	*Calidris melanotos*	-	Migratory	Species or species habitat may occur within area
Lesser Frigatebird, Least Frigatebird	*Fregata ariel*	-	Migratory	Species or species habitat may occur within area
Southern Giant-Petrel, Southern Giant Petrel	*Macronectes giganteus*	Endangered	Migratory	Species or species habitat may occur within area

Value/Sensitivity Common Name	Scientific Name	Threatened Status	Migratory Status	Presence within Operational Area
Eastern Curlew, Far Eastern Curlew	*Numenius madagascariensis*	Critically Endangered	Migratory	Species or species habitat may occur within area
White-tailed Tropicbird	*Phaethon lepturus*	-	Migratory	Species or species habitat may occur within area
Christmas Island White-tailed Tropicbird, Golden Bosunbird	*Phaethon lepturus fulvus*	Endangered	-	Species or species habitat may occur within area
Soft-plumaged Petrel	*Pterodroma mollis*	Vulnerable	-	Species or species habitat may occur within area
Australian Fairy Tern	*Sternula nereis nereis*	Vulnerable	-	Foraging, feeding or related behaviour likely to occur within area
Indian Yellow-nosed Albatross	*Thalassarche carteri*	Vulnerable	Migratory	Species or species habitat may occur within area

4.2.5 Greenhouse Gasses

Air quality in WA-32-L is consistent with natural conditions, and there are no point source emissions to air in WA-32-L. The ambient air quality in WA-32-L is a consequence of both local- and global-scale effects. The concentration of greenhouse gases, primarily carbon dioxide (CO_2), have been increasing globally because of anthropogenic activities (Figure 4-1). As a result, the average temperature of the Earth's atmosphere and oceans have been increasing. Global efforts to limit the increase in average global temperatures to 2° C above pre-industrial levels are being made.

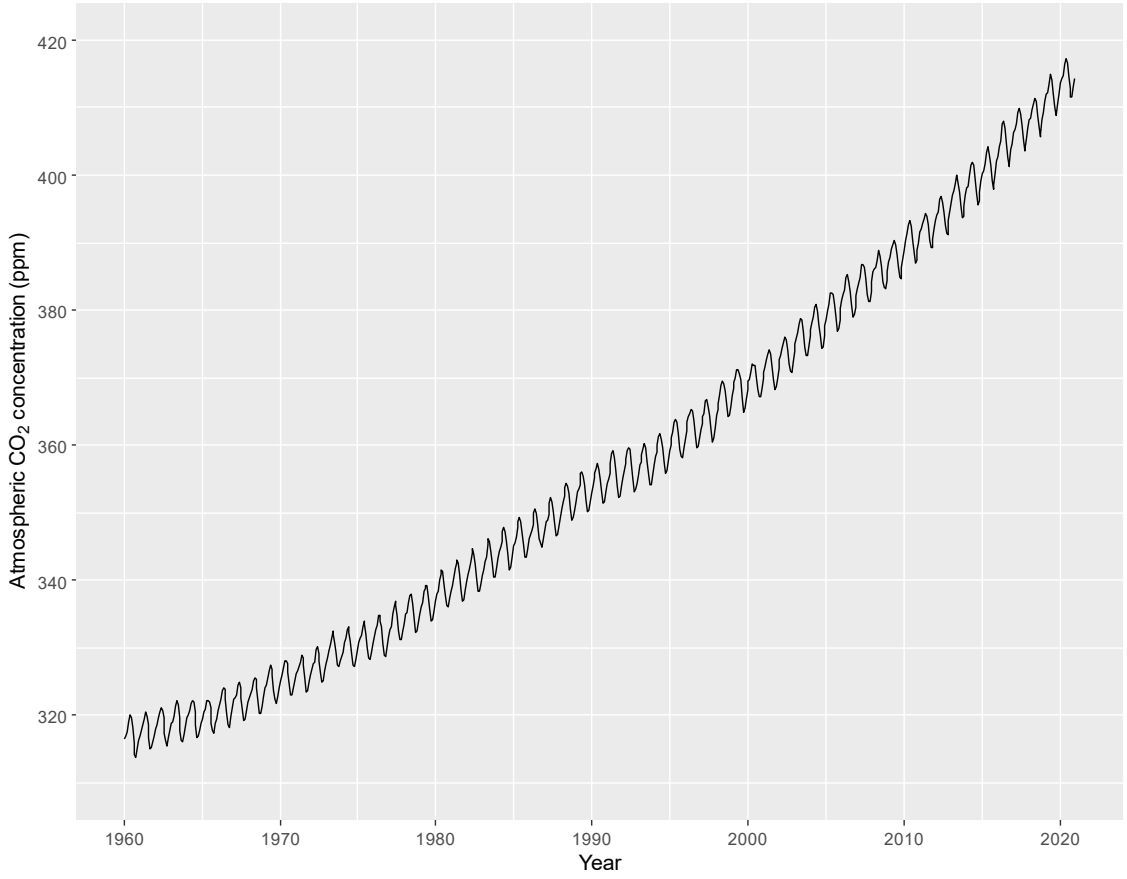


Figure 4-1 Global average atmospheric carbon dioxide concentrations between 1960 and 2020 (data from National Oceanic and Atmospheric Administration and United States Department of Commerce, n.d.)

4.2.6 Onshore Environmental Receptors

Onshore environmental receptors that may be impacted by the feasible decommissioning alternatives include:

- Ports, through the activities of vessels undertaking the feasible alternatives
- Storage and processing areas, required to store and process recovered equipment
- Onshore transportation infrastructure (e.g., roads) to transport material to the final disposal location
- Waste management facilities (e.g., landfill and recycling facilities) to handle the material from the recovered equipment.

The main ports supporting oil and gas activities in the region are Dampier, Onslow and Exmouth. Dampier is assumed to be the site from which vessels undertaking the feasible alternatives will operate. Dampier has an existing logistics services which are capable of handling and disposing of any materials recovered appropriately.

Where practicable, waste materials will be recycled. Only steel recovered from the equipment is likely to be economically recycled, and other materials are expected to be disposed of as landfill. Re-use of the recovered equipment is not considered feasible due to the degradation that may have occurred when in use.

4.2.7 Other Users

There are few other users of the sea within WA-32-L. The water depth and distance from shore generally precludes tourism and recreation.

There are other oil and gas facilities in the vicinity of WA-32-L, and a Woodside-operated pipeline partially overlaps WA-32-L. None of these existing oil and gas facilities or the pipeline will be credibly affected by the feasible decommissioning alternatives for the candidate equipment groups.

There are a number of State and Commonwealth-managed fisheries that overlap WA-32-L. These are summarised in Table 4-2. Only two fisheries may potentially interact with the feasible decommissioning alternatives:

- The Commonwealth-managed Western deep water trawl fishery
- The Western Australian-managed West coast deep sea crustacean fishery

Table 4-2: Commonwealth and state managed fisheries within WA-32-L

Fishery Name	Potential Interaction?	Description[1]
Commonwealth Fisheries		
Western Deep Water Trawl Fishery	Yes	The Western Deepwater Trawl Fishery operates in Commonwealth waters off the coast of Western Australia. Effort in recent years has been localised in the area offshore and slightly south of Shark Bay. Catch in the 2019–20 season was 31 t in total. Whilst the operational area overlaps with the fishery management area, there is very little potential for interaction given the current distribution of target species and fishing effort.
Western Tuna and Billfish Fishery	No	Fishing effort has concentrated off south-west Western Australia, with occasional activity off South Australia. Whilst there is an overlap with the fishery management area, there is no potential for interaction given the current distribution of fishing effort.
Sothern Bluefin Tuna Fishery	No	Fishing effort has concentrated off southern and eastern Australia. Whilst there is an overlap with the fishery management area, there is no potential for interaction given the current distribution of fishing effort.
Skipjack Tuna Fishery	No	There has been no fishing in the since 2008–09. Whilst the operational area overlaps with the fishery management area, there is no potential for interaction given the current distribution of fishing effort.
State Fisheries		
Pilbara Crab Fishery	No	Blue swimmer crabs are targeted by the Pilbara Crab Managed Fishery using hourglass traps, primarily within inshore waters around Nickol Bay and Dampier. Water depths in the operational area too deep to support the target species and the fishery is not active in the operational area.
Pilbara Line Fishery	No	The Pilbara Line Fishery encompasses all of the 'Pilbara waters', extending from a line commencing at the intersection of 21°56'S latitude and the boundary of the Australian Fishing Zone and north to longitude 120°E. There are no stated depth limits of the fishery. The fishing vessels primarily target demersal Lutjanid species such as goldband snapper, which typically occur in < 200 m water depth. Given the depth preferences of target species, no fishing in this fishery will occur in the operational area.
West Coast Deep Sea Crustacean	Yes	The West Coast Deep Sea Crustacean Fishery is a 'pot' fishery using baited pots operated in a long-line formation in the shelf edge waters (> 150 m) of the West Coast and Gascoyne Bioregions. The fishery primarily targets crystal crabs.
Mackerel Fishery	No	The Mackerel Managed Fishery targets Spanish mackerel (*Scomberomorus commerson*) using near-surface trawling gear from small vessels in coastal areas around reefs, shoals and headlands. The commercial fishery extends from Geraldton to the Northern Territory border. No interaction is expected given the gear type, habitat preference for target species (pelagic) and known fishing effort.

Fishery Name	Potential Interaction?	Description[1]
Marine Aquarium	No	The Marine Aquarium Managed Fishery operates within Western Australian waters. The fishery is primarily a dive-based fishery that uses hand-held nets to capture the desired target species and is restricted to safe diving depths (typically < 30 m). The fishery is typically active from Esperance to Broome, with popular areas including the coastal waters of the Cape Leeuwin/Cape Naturaliste region, Dampier and Exmouth. Water depths in the operational area are not conducive for this fishery.
South West Coast Salmon	No	The commercial salmon fishery use beach seine net to catch fish. There are two commercial salmon fisheries operating in Western Australia: the South Coast Salmon Managed Fishery (18 licences) and South West Coast Salmon Managed Fishery (six licences). The target species is restricted to temperate waters and will not occur in the Gascoyne or Pilbara.

[1] Fisheries descriptions derived from *Fishery Status Reports 2021* (Patterson et al., 2021) and *Status Report of the Fisheries and Aquatic Resources of Western Australia 2018/2019 - State of the Fisheries* (Gaughan and Santoro, 2020) unless cited otherwise.

4.3 Determining Weightings of Environmental Receptors

The criteria in the AHP hierarchy comprise (Section 4.1):

- Sediment quality
- Water quality
- Benthic habitats
- Marine fauna
- Greenhouse gasses
- Onshore environmental receptors
- Other users

All possible pairwise comparisons of these criteria are provided in Table 4-3, which details:

- The two criteria being compared (labelled A and B)
- Which of the criteria is of greater importance
- The magnitude of the difference in importance (if any) derived from Table 3-2
- A justification for the selected criterion and magnitude

The pairwise comparisons determine the relative weighting of each sub-criterion within the decommissioning alternatives environmental impact assessment. The resulting judgment matrix is provided in Table 4-4. The global priorities are provided in Table 4-5 and Figure 4-2.

Table 4-3: Pairwise comparisons of criteria for the AHP. Cell shading indicates the preferred criterion, with hue intensity reflecting the degree of preference (i.e., the rating column)

Criterion A	Criterion B	Preferred Criterion	Rating	Justification
Sediment Quality	Water Quality	A	3 - Moderate importance	Sediment quality has a high connectedness to marine ecosystems, hence impacts to sediment quality may also impact upon other receptors such as benthic habitats and fauna. Impacts to sediment quality, particularly contamination, may take a relatively long time to recover. Water quality has a high connectedness to marine ecosystems but has generally recovers quickly once a source of impact is no longer present. On this basis, sediment quality is of moderate importance compared to water quality.
Sediment Quality	Benthic Habitats	A	3 - Moderate importance	Sediment quality has a high connectedness to marine ecosystems, hence impacts to sediment quality may also impact upon other receptors such as benthic habitats and fauna. Impacts to sediment quality, particularly contamination, may take a relatively long time to recover. The benthic habitats that may be impacted by the feasible decommissioning alternatives are of low conservation value and are widely represented in the region. While both sediment quality and benthic habitat have a high connectivity with marine ecosystems, sediment quality is moderately more important than benthic habitat.
Sediment Quality	Marine Fauna	B	5 - Strong importance	Sediment quality has a high connectedness to marine ecosystems, hence impacts to sediment quality may also impact upon other receptors such as benthic habitats and fauna. Impacts to sediment quality, particularly contamination, may take a relatively long time to recover. The level of protection afforded by the EPBC Act to some fauna and their high ecological connectivity results in fauna being highly valued. While recognising the high environmental connectivity of sediment quality, marine fauna are of strong importance compared to sediment quality.
Sediment Quality	Greenhouse Gasses	A	3 - Moderate importance	Sediment quality has a high connectedness to marine ecosystems, hence impacts to sediment quality may also impact upon other receptors such as benthic habitats and fauna. Impacts to sediment quality, particularly contamination, may take a relatively long time to recover. Greenhouse gas emissions that may credibly arise from the feasible decommissioning alternatives are negligible in the context of maritime industry emissions in Australia. Greenhouse gas emissions receive scrutiny from Woodside's internal and external stakeholders. Hence, sediment quality is of moderate importance compared to greenhouse gasses.
Sediment Quality	Onshore Environmental Receptors	A	5 - Strong importance	Sediment quality has a high connectedness to marine ecosystems, hence impacts to sediment quality may also impact upon other receptors such as benthic habitats and fauna. Impacts to sediment quality, particularly contamination, may take a relatively long time to recover. Impacts to onshore environmental receptors would occur within the land management context, such as local, state and Commonwealth requirements. Complying with the requirements of the land management context is expected to ensure that impacts to onshore environmental receptors are acceptable and do not affect unique or vulnerable environmental values. Considering the preceding points, sediment quality is of strong importance compared to onshore environmental receptors.

Criterion A	Criterion B	Preferred Criterion	Rating	Justification
Sediment Quality	Other Users	B	3 - Moderate importance	Sediment quality has a high connectedness to marine ecosystems, hence impacts to sediment quality may also impact upon other receptors such as benthic habitats and fauna. Impacts to sediment quality, particularly contamination, may take a relatively long time to recover. Woodside values the opinions of stakeholders and is required to consider any claims or objections raised by them and respects their rights to access the marine environment. While acknowledging the high connectivity of sediment quality to marine ecosystems, other users are of moderate importance compared to sediment quality due to the interest expressed by stakeholders to date and the value places on the rights of other users by environmental regulators.
Water Quality	Benthic Habitats	A	3 - Moderate importance	Water quality has a high connectedness to marine ecosystems but has generally recovers quickly once a source of impact is no longer present. The benthic habitats that may be impacted by the feasible decommissioning alternatives are of low conservation value and are widely represented in the region. While both water quality and benthic habitats have a high connectivity with marine ecosystems, water quality is of moderate importance compared to benthic habitat.
Water Quality	Marine Fauna	B	5 - Strong importance	Water quality has a high connectedness to marine ecosystems but has generally recovers quickly once a source of impact is no longer present. The level of protection afforded by the EPBC Act to some fauna and their high ecological connectivity results in fauna being highly valued. Hence, marine fauna are of strong importance compared to water quality.
Water Quality	Greenhouse Gasses	A	3 - Moderate importance	Water quality has a high connectedness to marine ecosystems but has generally recovers quickly once a source of impact is no longer present. Water quality is of moderate importance compared to greenhouse gasses. Greenhouse gas emissions that may credibly arise from the feasible decommissioning alternatives are negligible in the context of maritime industry emissions in Australia. Greenhouse gas emissions receive scrutiny from Woodside's internal and external stakeholders. Water quality is of moderate importance compared to greenhouse gas emissions.
Water Quality	Onshore Environmental Receptors	A	3 - Moderate importance	Water quality has a high connectedness to marine ecosystems but has generally recovers quickly once a source of impact is no longer present. Impacts to onshore environmental receptors would occur within the land management context, such as local, state and Commonwealth requirements. Complying with the requirements of the land management context is expected to ensure that impacts to onshore environmental receptors are acceptable and do not affect unique or vulnerable environmental values. Considering the preceding points, water quality is of moderate importance compared to onshore environmental receptors.
Water Quality	Other Users	B	3 - Moderate importance	Water quality has a high connectedness to marine ecosystems but has generally recovers quickly once a source of impact is no longer present. Woodside values the opinions of stakeholders and is required to

Criterion A	Criterion B	Preferred Criterion	Rating	Justification
				consider any claims or objections raised by them and respects their rights to access the marine environment. While acknowledging the high connectivity of water quality to marine ecosystems, other users are of strong importance compared to water quality due to the potential consequences to other users and the interest expressed by stakeholders to date.
Benthic Habitats	Marine Fauna	B	5 - Strong importance	The benthic habitats that may be impacted by the feasible decommissioning alternatives are of low conservation value and are widely represented in the region. The level of protection afforded by the EPBC Act to some fauna and their high ecological connectivity results in fauna being highly valued. Marine fauna are of strong importance compared to benthic habitats.
Benthic Habitats	Greenhouse Gasses	A	3 - Moderate importance	The benthic habitats that may be impacted by the feasible decommissioning alternatives are of low conservation value and are widely represented in the region. Greenhouse gas emissions that may credibly arise from the feasible decommissioning alternatives are negligible in the context of maritime industry emissions in Australia. Greenhouse gas emissions receive scrutiny from Woodside's internal and external stakeholders. Benthic habitats are of moderate importance compared to greenhouse gasses.
Benthic Habitats	Onshore Environmental Receptors	A	3 - Moderate importance	The benthic habitats that may be impacted by the feasible decommissioning alternatives are of low conservation value and are widely represented in the region. Impacts to onshore environmental receptors would occur within the land management context, such as local, state and Commonwealth requirements. Complying with the requirements of the land management context is expected to ensure that impacts to onshore environmental receptors are acceptable and do not affect unique or vulnerable environmental values. Considering the preceding points, benthic habitats are of moderate importance compared to onshore environmental receptors.
Benthic Habitats	Other Users	B	3 - Moderate importance	The benthic habitats that may be impacted by the feasible decommissioning alternatives are of low conservation value and are widely represented in the region. Woodside values the opinions of stakeholders and is required to consider any claims or objections raised by them and respects their rights to access the marine environment. While acknowledging the high connectivity of benthic habitats to marine ecosystems, other users are of strong importance compared to benthic habitats due to the potential consequences to other users and the interest expressed by stakeholders to date.
Marine Fauna	Greenhouse Gasses	A	7 - Very strong importance	The level of protection afforded by the EPBC Act to some fauna and their high ecological connectivity results in fauna being highly values. Greenhouse gas emissions that may credibly arise from the feasible decommissioning alternatives are negligible in the context of maritime industry emissions in Australia. Greenhouse gas emissions receive scrutiny from Woodside's internal and external stakeholders. Marine fauna are of very strong importance compared to greenhouse gas emissions.

Criterion A	Criterion B	Preferred Criterion	Rating	Justification
Marine Fauna	Onshore Environmental Receptors	A	7 - Very strong importance	The level of protection afforded by the EPBC Act to some fauna and their high ecological connectivity results in fauna being highly values. Impacts to onshore environmental receptors would occur within the land management context, such as local, state and Commonwealth requirements. Complying with the requirements of the land management context is expected to ensure that impacts to onshore environmental receptors are acceptable and do not affect unique or vulnerable environmental values. Considering the preceding points, marine fauna are of very strong importance compared to onshore environmental receptors.
Marine Fauna	Other Users	-	1 - Equal importance	The level of protection afforded by the EPBC Act to some fauna and their high ecological connectivity results in fauna being highly values. Woodside values the opinions of stakeholders and is required to consider any claims or objections raised by them and respects their rights to access the marine environment. Both marine fauna and other users are of considerable importance and impacts to either of these receptors are likely to be less tolerable than impacts to other receptors. The relative importance of marine fauna and other users are of equal importance.
Greenhouse Gasses	Onshore Environmental Receptors	-	1 - Equal importance	Greenhouse gas emissions that may credibly arise from the feasible decommissioning alternatives are negligible in the context of maritime industry emissions in Australia. Greenhouse gas emissions receive scrutiny from Woodside's internal and external stakeholders. Impacts to greenhouse gasses and onshore environmental receptors are of equal importance.
Greenhouse Gasses	Other Users	B	5 - Strong importance	Greenhouse gas emissions that may credibly arise from the feasible decommissioning alternatives are negligible in the context of maritime industry emissions in Australia. Greenhouse gas emissions receive scrutiny from Woodside's internal and external stakeholders. Woodside values the opinions of stakeholders and is required to consider any claims or objections raised by them and respects their rights to access the marine environment. While acknowledging the public interest and global impacts of greenhouse gas emissions, other users are of strong importance compared to greenhouse gasses due to the potential consequences to other users and the interest expressed by stakeholders to date.
Onshore Environmental Receptors	Other Users	B	5 - Strong importance	Impacts to onshore environmental receptors would occur within the land management context, such as local, state and Commonwealth requirements. Complying with the requirements of the land management context is expected to ensure that impacts to onshore environmental receptors are acceptable and do not affect unique or vulnerable environmental values. Woodside values the opinions of stakeholders and is required to consider any claims or objections raised by them and respects their rights to access the marine environment. Hence, other users are of very strong importance compared to onshore environmental receptors due to the potential consequences to other users and the interest expressed by stakeholders to date.

Table 4-4: Local priorities judgment matrix for criteria-level comparisons (as described in Section 2.4)

	Sediment Quality	Water Quality	Benthic Habitats	Marine Fauna	Greenhouse Gasses	Onshore Environmental Receptors	Other Users
Sediment Quality	1	3	3	0.14	3	5	0.2
Water Quality	0.33	1	3	0.2	3	3	0.2
Benthic Habitats	0.33	0.33	1	0.2	3	3	0.14
Marine Fauna	7	5	5	1	7	7	1
Greenhouse Gasses	0.33	0.33	0.33	0.14	1	1	0.14
Onshore Environmental Receptors	0.2	0.33	0.33	0.14	1	1	0.14
Other Users	5	5	7	1	7	7	1
Sum	14.2	15	19.7	2.83	25	27	2.83

Table 4-5: Global priorities for criteria

Criteria	Global Priority
Sediment Quality	14.5%
Water Quality	10.3%
Benthic Habitats	7.7%
Marine Fauna	34.6%
Greenhouse Gasses	3.9%
Onshore Environmental Receptors	3.7%
Other Users	25.3%
Sum	100%

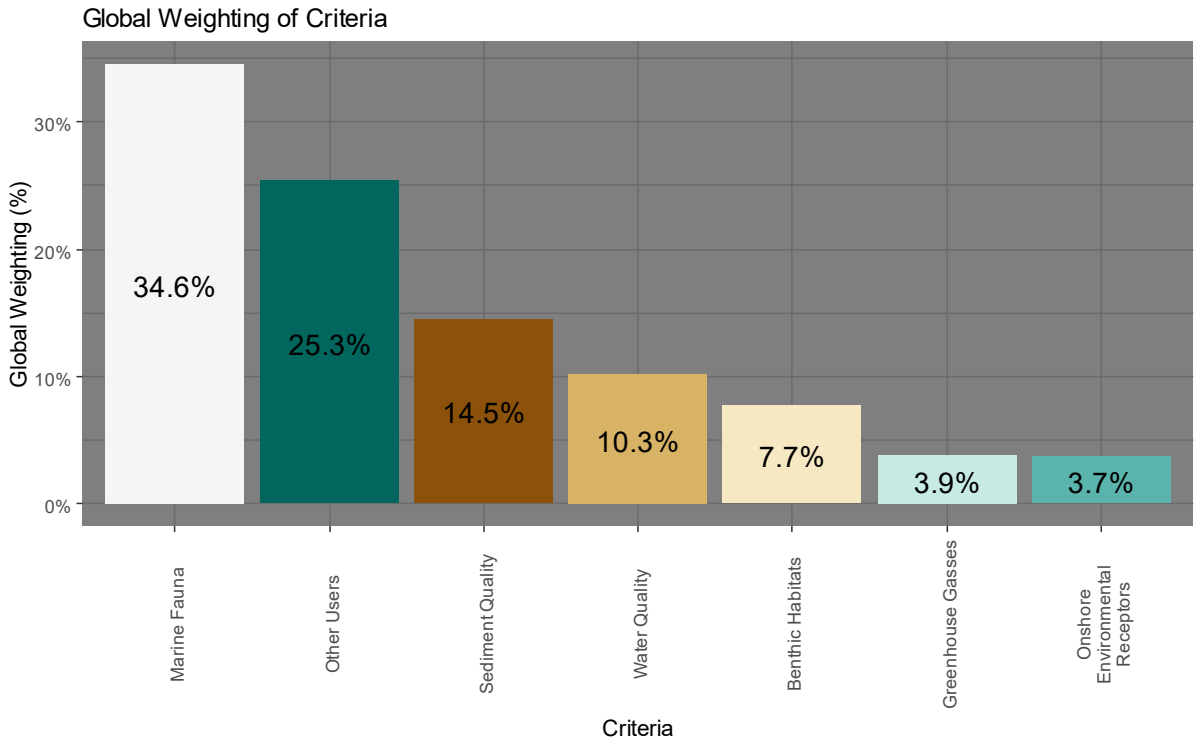


Figure 4-2: Weightings for criteria within the AHP hierarchies for the feasible decommissioning alternatives

5 Environmental Impact Assessment of Decommissioning Alternatives

This section contains a series of comparative environmental impact assessments of the feasible options for the DTM anchors (Section 5.1) and suction piles (Section 5.2). Each of these comparative environmental impact assessments considers the suite of environmental receptors and associated weightings determined in Section 4.3.

Summaries of the environmental values for each of the criteria are provided in Table 5-1. These summaries, along with the descriptions in Section 4.2, informed the deliberations made when comparing the feasible decommissioning options for the candidate equipment groups.

Table 5-1: Descriptions of the environmental values of the criteria

Criterion	Description of Criterion Value
Sediment Quality	Sediment quality values are very widely represented in the region. Sampling in the field by Cardno (2019) indicates sediment quality is generally high in WA-32-L, with some minor increased of contaminant concentrations around drill centres. Sediment quality is highly connected to other environmental values, such as benthic habitats and deposit-feeding fauna. Impacts to sediment quality may take a long time to recover to pre-impact levels.
Water Quality	Water quality values are ubiquitous in the region. Water quality has a high connectedness to marine ecosystems but has generally recovers quickly once a source of impact is no longer present.
Benthic Habitats	The benthic habitats in WA-32-L are primarily associated with bare muddy, silty and sandy sediments. There are no known complex relief benthic habitats (e.g., reefs). The equipment in WA-32-L has very low levels of marine growth.
Marine Fauna	Fauna within WA-32-L are widely represented within the region and are not particularly unique, although such fauna are concentrated around reefs. Some of the fauna are protected under the EPBC Act. Consultation has indicated the importance placed on marine fauna by some stakeholders.
Greenhouse Gasses	Concentrations of greenhouse gasses in the atmosphere have been steadily increasing, resulting in anthropogenic climate change. The potential emissions from any of the feasible alternatives is negligible in the context of regional emissions, national and global emissions. Greenhouse gasses may persist for long periods of time in the atmosphere and the effects of climate change occur globally.
Onshore Environmental Receptors	Onshore environmental receptors may be impacted by the management of waste materials. This includes personnel exposed to potential safety risks from waste materials and groundwater resources that may be impacted by contaminants leaching from landfill facilities. Aspects that may impact upon onshore environmental receptors are well-regulated by Western Australian and Commonwealth legislation.
Other Users	There is very little historical or current activities by other users in WA-32-L. There is oil and gas production facilities in adjacent petroleum titles.

5.1 DTM Anchors

This section summarises the decommissioning alternatives environmental impact assessment for the DTM anchors. Refer to Section 2.1 for a description of this equipment group. The outcomes of the assessment for are shown in Figure 5-1 and Figure 5-2. The AHP hierarchy for this comparative assessment is shown in Figure 5-3.

Pairwise comparisons for the decommissioning alternatives for the DTM anchors within each criterion are provided in Table 5-2, with AHP calculations provided in Appendix A.

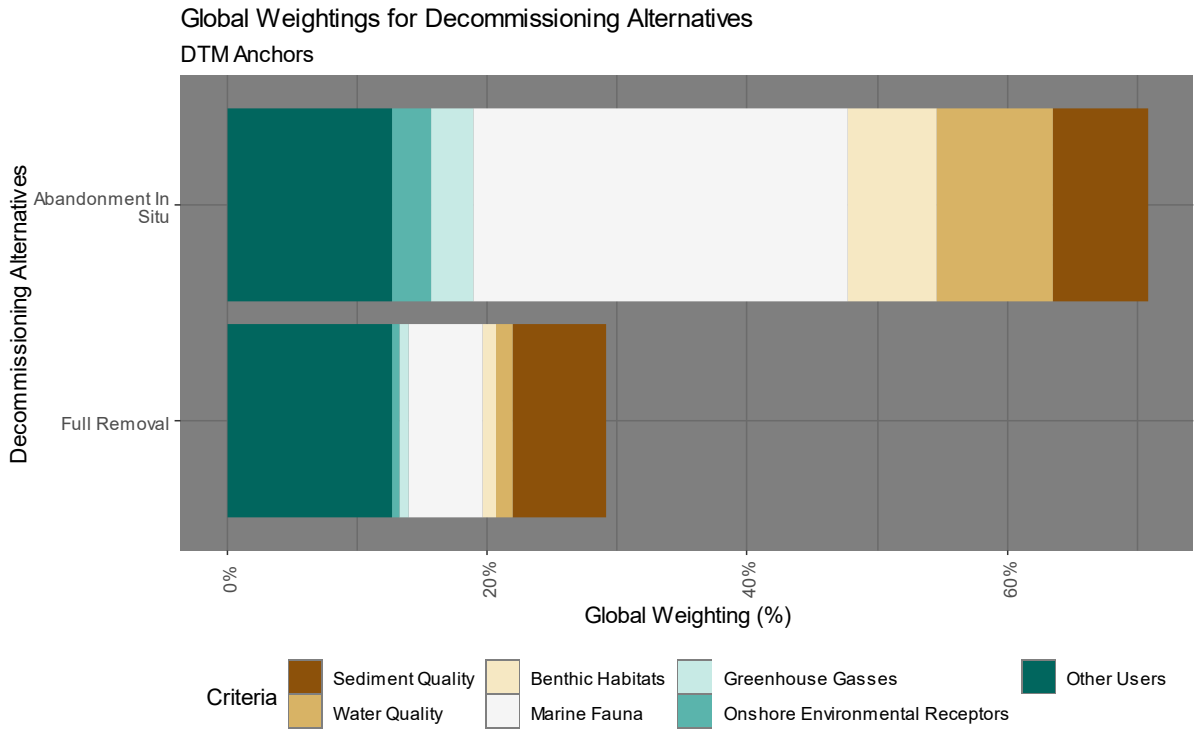


Figure 5-1: Stacked bar plot of global preference of the decommissioning alternatives for the DTM anchors

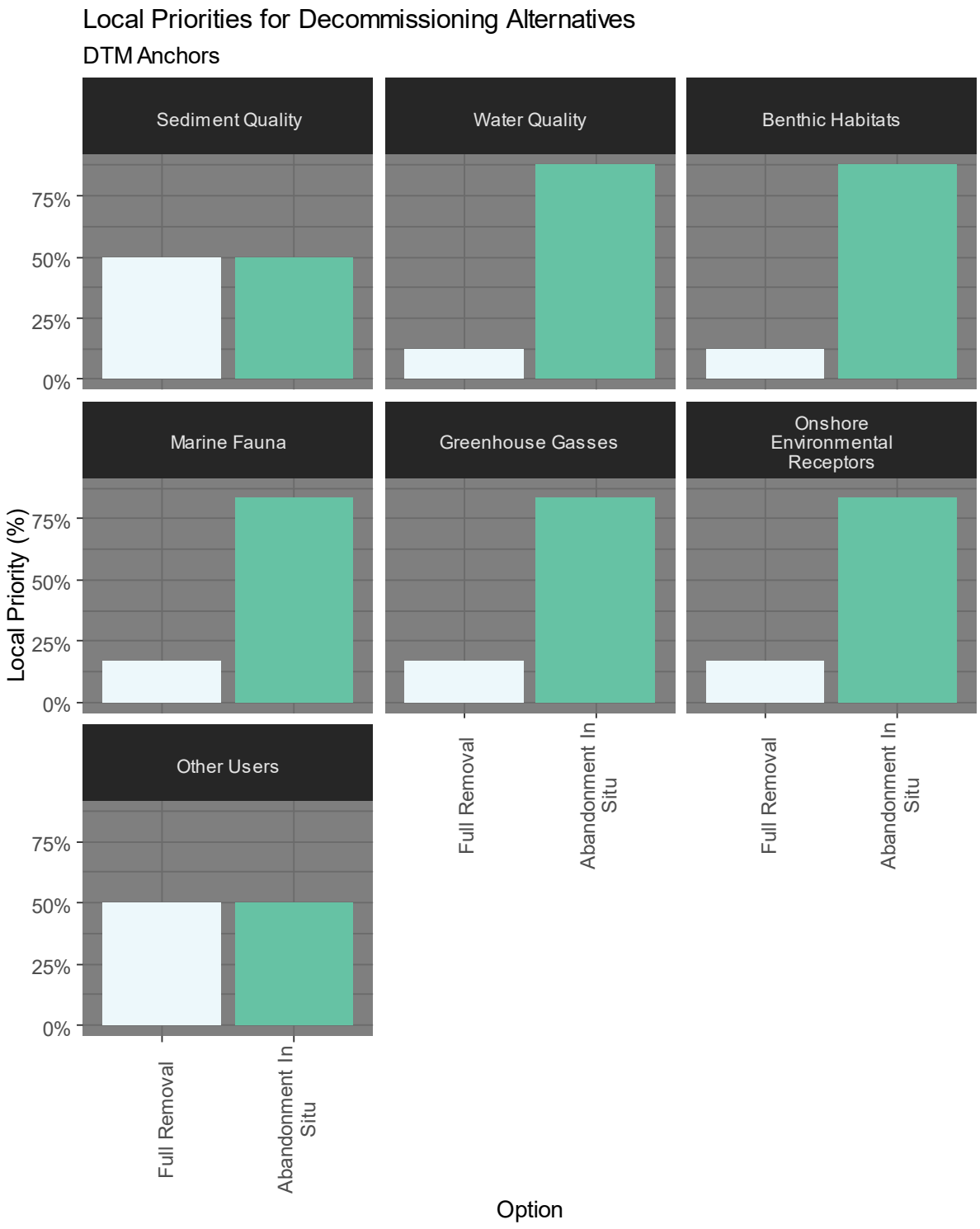


Figure 5-2: Local weighting for the decommissioning alternatives within environmental receptors for the DTM anchors

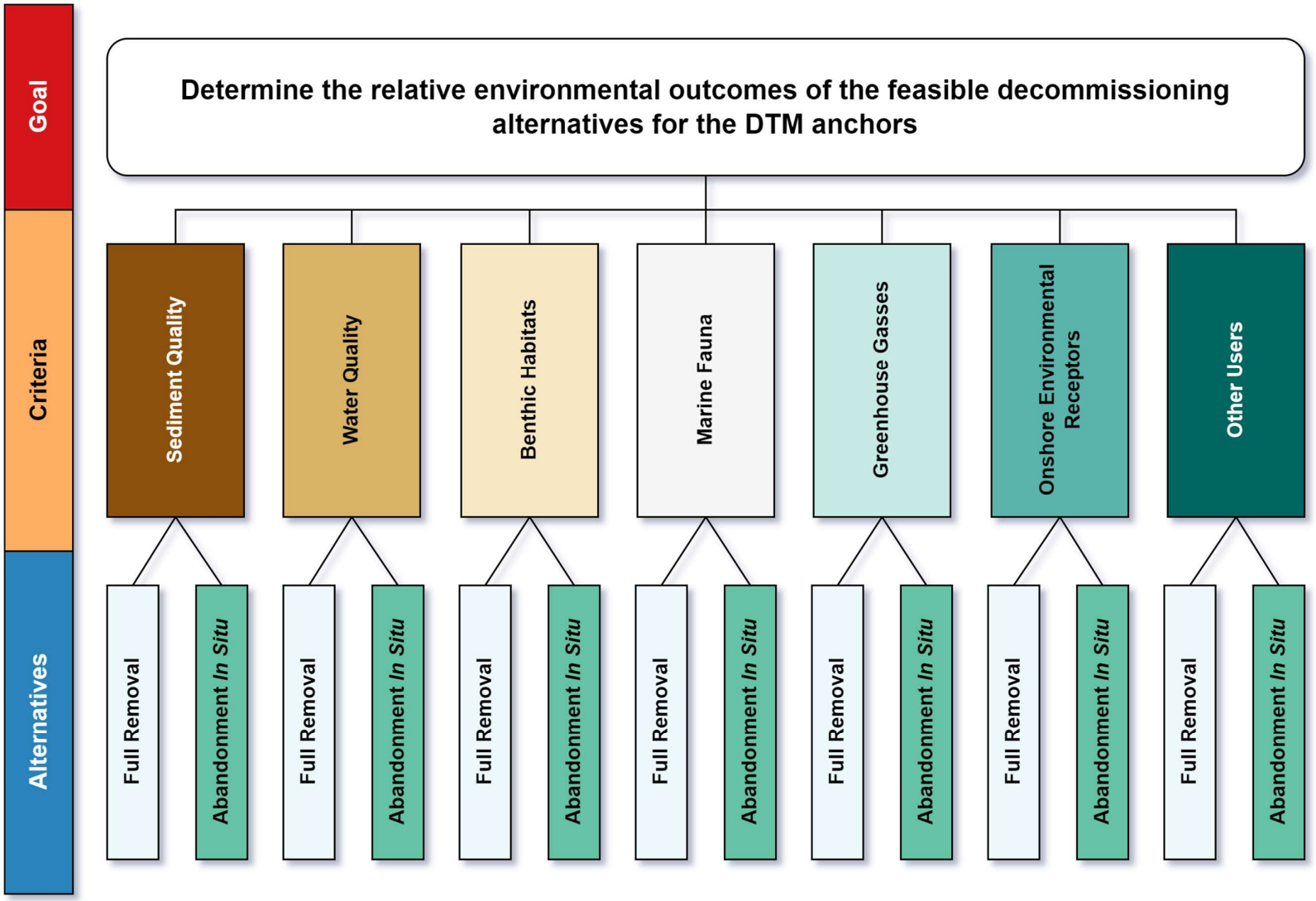


Figure 5-3: AHP hierarchy for DTM anchors decommissioning alternatives environmental impact assessment

Table 5-2: Pairwise comparisons of decommissioning alternatives for the DTM anchors

Criterion A	Criterion B	Preferred Criterion	Rating	Justification
Sediment Quality				
Full removal	Abandonment *in situ*	-	1 – Equal preference	The full removal alternative will result in substantial disturbance to sediments, remobilising sediments and leaving anchor scars (10s of metres in length) at each anchor location. This may remobilise contaminants in the sediments, although Cardno (2019) found concentrations of most potential contaminants were below the trigger values in the *Australian and New Zealand Guidelines for Fresh and Marine Water Quality* (Australian and New Zealand Environment and Conservation Council and Agriculture and Resource Management Council of Australia and New Zealand, 2000). Abandonment *in situ* will not result in any direct disturbance of sediments. Degradation of the anchors following abandonment *in situ* will result in changes to the composition of sediments around the anchors. Steel material will rust as the anchors degrade, with rust flakes breaking away and being incorporated into the sediments. This process will result in the increase in the concentration of iron in the sediments around the anchors. Iron is not recognised as a potential toxicant in sediments and the *Australian and New Zealand Guidelines for Fresh and Marine Water* (Commonwealth of Australia and New Zealand Government, 2018) do not provide trigger values for iron in sediments. The increased concentrations of iron in sediments are not expected to result in any biological impacts. The full removal and abandonment *in situ* alternatives are equally preferred within the sediment quality criterion.
Water Quality				
Full removal	Abandonment *in situ*	B	7 – Very strong importance	Full removal of the anchors will result in resuspension of sediments due to the removal of the anchors, all of which are embedded several metres within the seabed. Resuspended sediments are expected to be deposited within 100s of metres over the course of hours. This will result in a localised, short-term decrease in water quality due to higher levels of turbidity and suspended sediments. Routine discharges form vessels undertaking the full removal alternative (e.g., grey water, sewage etc.) will result in potential changes to water quality at the discharge location. These changes to water quality will be localised around the discharge location and are only expected to be detectable within 10s to 100s of metres. Recovery to baseline conditions will occur rapidly (10s of minutes) upon cessation of the discharge due to natural mixing. The environmental receptors within the environment that may be affected by these impacts to water quality are not particularly sensitive or of high environmental value.

Criterion A	Criterion B	Preferred Criterion	Rating	Justification
				Degradation of the anchors following abandonment *in situ* will release degradation products. As the anchors are completely embedded in the seabed, these degradation products have no direct pathway to the water column. The degradation products from steel have low to very low solubility, and hence will not substantially change the characteristics of seawater. No resuspension of sediments due to scouring will occur. As such, the abandonment *in situ* alternative will have no impact upon water quality. Consequently, abandonment *in situ* is very strongly preferred over full removal within the water quality criterion.
Benthic Habitats				
Full removal	Abandonment *in situ*	B	7 – Very strong importance	The full removal alternative will result in substantial disturbance to benthic habitats around the anchors, remobilising sediments and leaving anchor scars (10s of metres in length) at each anchor location. Recovery of fauna from this disturbance is expected to occur within 10 years (Hiddink et al., 2017), although depressions in the seabed may be visible for substantially longer. The benthic habitats that would be disturbed are bare sediment habitats, which are widely represented in the region and not considered to be of high conservation value. Abandonment *in situ* will not result in any direct disturbance of benthic habitats and will preserve the habitats that have become established around the anchors. Consequently, the abandonment *in situ* alternative is very strongly preferred over the full removal alternative within the benthic habitats criterion.
Marine Fauna				
Full removal	Abandonment *in situ*	B	5 – Strong preference	The full removal alternative will substantially disturb benthic habitats around the anchors. This habitat is expected to host infauna and epifauna assemblages that are widely represented in the region. The anchors are completely embedded, and do not provide hard substrate for sessile benthic fauna or habitat for fishes. The recovery of fauna is expected to occur within 10 years (Hiddink et al., 2017). The benthic habitats that would be disturbed are bare sand habitats, which are widely represented in the region and not considered to be of high conservation value. Vessel activities to implement the full removal alternatives may also impact upon fauna. The equipment is located within a pygmy blue whale migration BIA. Underwater noise from vessels using dynamic positioning may induce behavioural responses in fauna, such as migrating whales. Abandonment *in situ* will not result in any direct disturbance of benthic habitats and will preserve the habitats that have become established around the anchors. Degradation products pose negligible risk to fauna and will be sequestered within the sediment.

Criterion A	Criterion B	Preferred Criterion	Rating	Justification
				Consequently, the abandonment *in situ* alternative is strongly preferred over the full removal alternative within the benthic habitats criterion.
Greenhouse Gasses				
Full removal	Abandonment *in situ*	B	5 – Strong preference	The full removal alternative will generate carbon dioxide emissions from fuel combustion. Carbon dioxide is a greenhouse gas, which will result in indirect environmental impacts from climate change. These emissions are negligible in the context of offshore vessel emissions in Australia. The abandonment *in situ* alternative will not generate any greenhouse gas emissions. However, the steel in the anchors will not be available for recycling. Consequently, the abandonment *in situ* alternative is strongly preferred to the full removal option within the greenhouse gasses criterion.
Onshore Environmental Receptors				
Full removal	Abandonment *in situ*	B	5 – Strong preference	The full removal alternative will impact upon onshore environmental receptors due to onshore disposal of the recovered anchors. The waste materials may be disposed of by reusing (e.g., redeployment as anchors), recycling (e.g., scrap steel recycling), or landfill. Waste management facilities are assumed to be available at a nearby port, such as Dampier. These ports have cleared land suitable for the storage and processing of the anchors, as well as receiving vessel-based wastes. No clearing or construction of new facilities will be required. The abandonment *in situ* alternative will not generate waste requiring onshore disposal. However, the steel in the anchors will not be available for recycling. Consequently, the abandonment *in situ* option is strongly preferred within the onshore environmental receptors criterion.
Other Users				
Full removal	Abandonment *in situ*	-	1 – Equal preference	The anchors are embedded within the seabed and provide no habitat for fish, nor do they pose a hazard to trawled fishing gear. The removal activity may result in localised displacement of other users; however, this impact will be negligible given the very low levels of activity in WA-32-L. Abandonment *in situ* will have no impact upon other users. Commercial fishers using trawled gear will not credibly be impacted given the lack of fish resources, lack of fishing effort and deeply embedded status of the anchors. Consequently, both options are equally preferred within the other users criterion.

5.2 Suction Piles

This section summarises the decommissioning alternatives environmental impact assessment for the suction piles. Refer to Section 2.2 for a description of this equipment group. The outcomes of the assessment for are shown in Figure 5-4 and Figure 5-5. The AHP hierarchy for this comparative assessment is shown in Figure 5-6.

Pairwise comparisons for the decommissioning alternatives for the suction piles within each criterion are provided in Table 5-3, with AHP calculations provided in Appendix B.

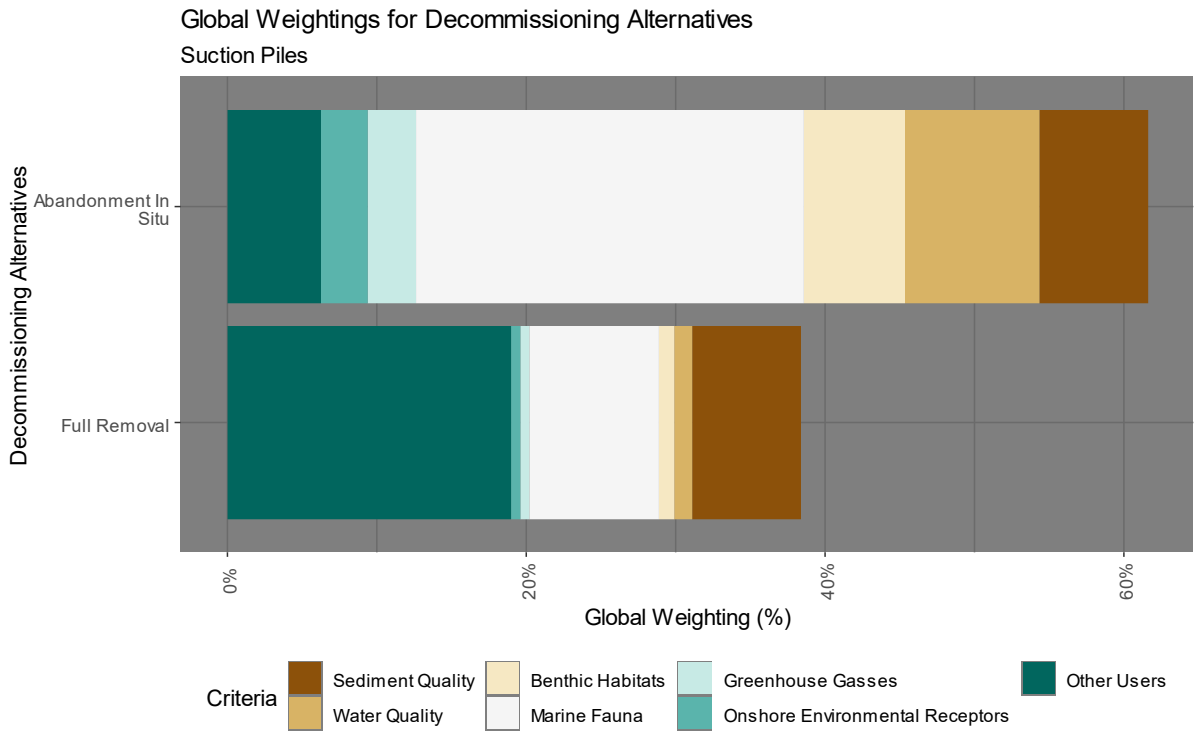


Figure 5-4: Stacked bar plot of global preference of the decommissioning alternatives for the suction piles

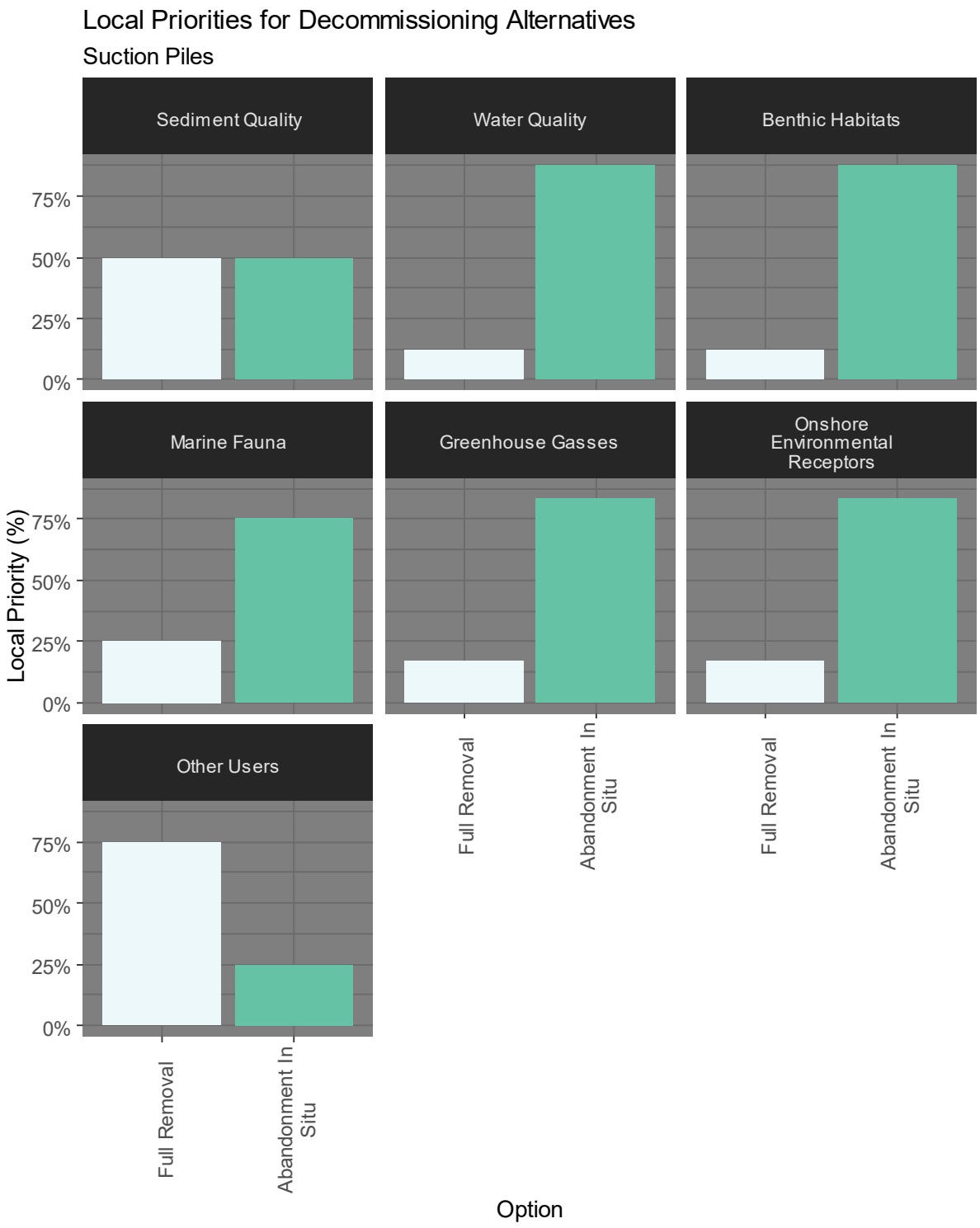


Figure 5-5: Local weighting for the decommissioning alternatives within environmental receptors for the suction piles

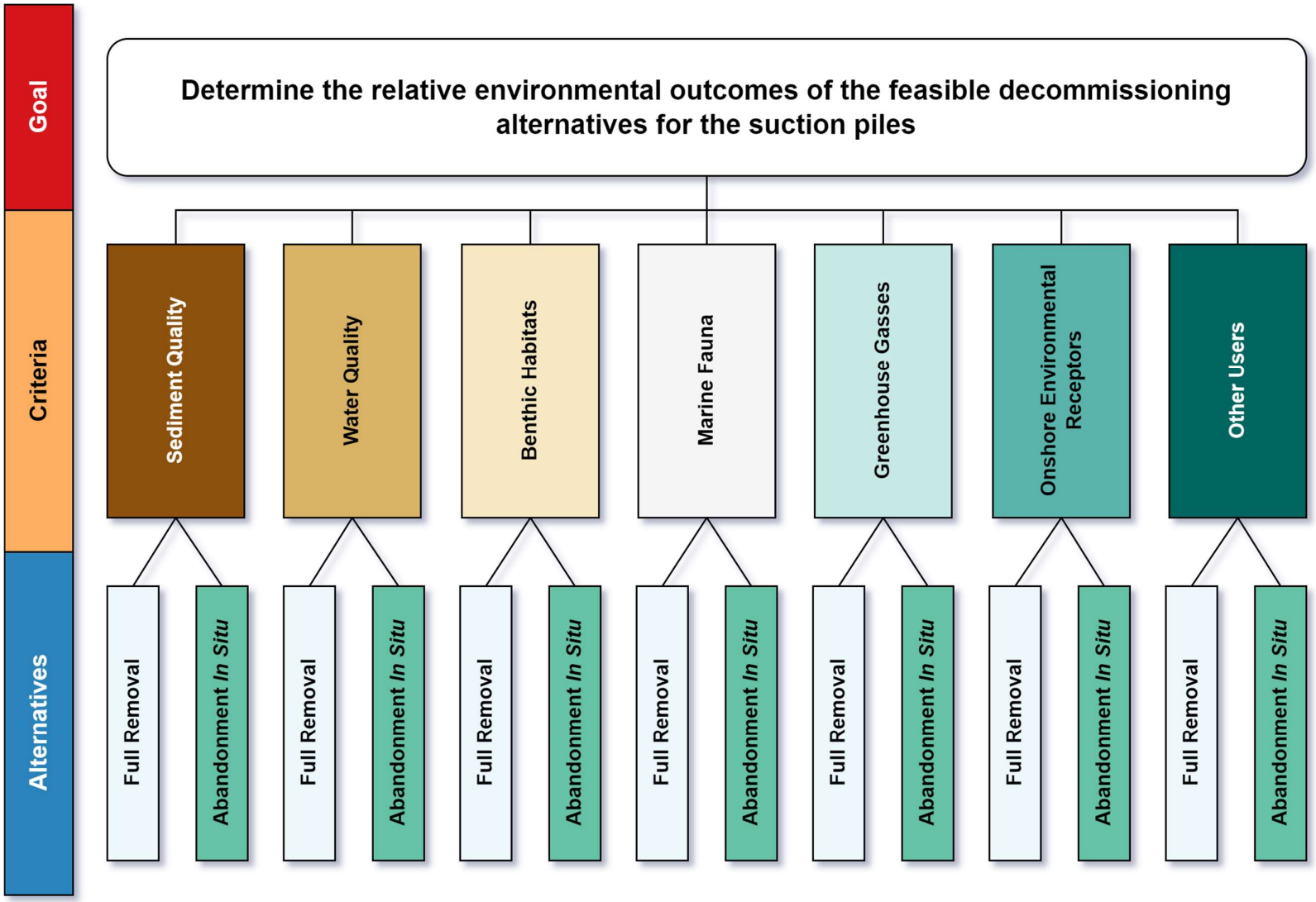


Figure 5-6: AHP hierarchy for suction piles decommissioning alternatives environmental impact assessment

Table 5-3: Pairwise comparisons of decommissioning alternatives for the suction piles

Criterion A	Criterion B	Preferred Criterion	Rating	Justification
Sediment Quality				
Full removal	Abandonment *in situ*	-	1 – Equal preference	The full removal alternative will result in substantial disturbance to sediments, remobilising sediments and leaving a hole in the seabed at each pile location. This may remobilise contaminants in the sediments, although Cardno (2019) found concentrations of most potential contaminants were below the trigger values in the *Australian and New Zealand Guidelines for Fresh and Marine Water Quality* (Australian and New Zealand Environment and Conservation Council and Agriculture and Resource Management Council of Australia and New Zealand, 2000). Abandonment *in situ* will not result in any direct disturbance of sediments. Degradation of the suction piles following abandonment *in situ* will result in changes to the composition of sediments around the piles. Steel material will rust as the piles degrade, with rust flakes breaking away and being incorporated into the sediments. This process will result in the increase in the concentration of iron in the sediments around the piles. Iron is not recognised as a potential toxicant in sediments and the *Australian and New Zealand Guidelines for Fresh and Marine Water* (Commonwealth of Australia and New Zealand Government, 2018) do not provide trigger values for iron in sediments. The increased concentrations of iron in sediments are not expected to result in any biological impacts. Alloying materials are present in the steel in very low levels and are unlikely to result in concentrations above the guideline values in the *Australian and New Zealand Guidelines for Fresh and Marine Water* (Commonwealth of Australia and New Zealand Government, 2018). The full removal and abandonment *in situ* alternatives are equally preferred within the sediment quality criterion.
Water Quality				
Full removal	Abandonment *in situ*	B	7 – Very strong importance	Full removal of the suction piles will result in resuspension of sediments due to the removal of the piles, all of which are embedded several metres within the seabed. Resuspended sediments are expected to be deposited within 100s of metres over the course of hours. This will result in a localised, short-term decrease in water quality due to higher levels of turbidity and suspended sediments. Routine discharges form vessels undertaking the full removal alternative (e.g., grey water, sewage etc.) will result in potential changes to water quality at the discharge location. These changes to water quality will be localised around the discharge location and are only expected to be detectable within 10s to 100s of metres. Recovery to baseline conditions will occur rapidly (10s of minutes) upon cessation of the discharge due to natural

Criterion A	Criterion B	Preferred Criterion	Rating	Justification
				mixing. The environmental receptors within the environment that may be affected by these impacts to water quality are not particularly sensitive or of high environmental value. Degradation of the suction piles following abandonment *in situ* will release degradation products. As the piles are largely embedded in the seabed, the majority of the degradation products do not have direct pathway to the water column. The degradation products from steel have low to very low solubility, and hence will not substantially change the characteristics of seawater. No resuspension of sediments due to scouring will occur. As such, the abandonment *in situ* alternative will have no impact upon water quality. Consequently, abandonment *in situ* is very strongly preferred over full removal within the water quality criterion.
Benthic Habitats				
Full removal	Abandonment *in situ*	B	7 – Very strong importance	The full removal alternative will result in substantial disturbance to benthic habitats around the suction piles, although these habitats will be disturbed by the equipment removal campaign. Removal of the piles will remobilise sediments and leave holes in the seabed at each pile location. Sediment will slump into the hole, resulting in a relatively shallow depression in the seabed. Recovery of fauna from this disturbance is expected to occur within 10 years (Hiddink et al., 2017), although depressions in the seabed may be visible for substantially longer. The benthic habitats that would be disturbed are bare sediment habitats, which are widely represented in the region and not considered to be of high conservation value. Abandonment *in situ* will not result in any direct disturbance of benthic habitats and will preserve the habitats that have become established around the suction piles. Consequently, the abandonment *in situ* alternative is very strongly preferred over the full removal alternative within the benthic habitats criterion.
Marine Fauna				
Full removal	Abandonment *in situ*	B	5 – Strong preference	The full removal alternative will substantially disturb benthic habitats around the suction piles. This habitat is expected to host infauna and epifauna assemblages that are widely represented in the region. The piles are embedded; however, the tops of the piles may be at or near the seabed and hence provide hard substrate habitat. The benthic habitats that would be disturbed are bare sand habitats, which are widely represented in the region and not considered to be of high conservation value. Vessel activities to implement the full removal alternatives may also impact upon fauna. The equipment is located within a pygmy blue whale migration BIA. Underwater noise from vessels using dynamic positioning may induce behavioural responses in fauna, such as migrating whales.

Criterion A	Criterion B	Preferred Criterion	Rating	Justification
				Abandonment *in situ* will not result in any direct disturbance of benthic habitats and will preserve the habitats that have become established around the suction piles. Degradation products pose negligible risk to fauna and will be sequestered within the sediment. Consequently, the abandonment *in situ* alternative is strongly preferred over the full removal alternative within the benthic habitats criterion.
Greenhouse Gasses				
Full removal	Abandonment *in situ*	B	5 – Strong preference	The full removal alternative will generate carbon dioxide emissions from fuel combustion. Carbon dioxide is a greenhouse gas, which will result in indirect environmental impacts from climate change. These emissions are negligible in the context of offshore vessel emissions in Australia. The abandonment *in situ* alternative will not generate any greenhouse gas emissions. However, the steel in the suction piles will not be available for recycling. Consequently, the abandonment *in situ* alternative is strongly preferred to the full removal option within the greenhouse gasses criterion.
Onshore Environmental Receptors				
Full removal	Abandonment *in situ*	B	5 – Strong preference	The full removal alternative will impact upon onshore environmental receptors due to onshore disposal of the recovered suction piles. The waste materials may be disposed of by recycling (e.g., scrap steel recycling) or landfill. The suction piles are unlikely to be suitable for reuse. Waste management facilities are assumed to be available at a nearby port, such as Dampier. These ports have cleared land suitable for the storage and processing of the suction piles, as well as receiving vessel-based wastes. No clearing or construction of new facilities will be required. The abandonment *in situ* alternative will not generate waste requiring onshore disposal. However, the steel in the suction piles will not be available for recycling. Consequently, the abandonment *in situ* option is strongly preferred within the onshore environmental receptors criterion.
Other Users				
Full removal	Abandonment *in situ*	A	3 – Moderate preference	The suction piles are embedded within the seabed and provide negligible habitat for fish. The water injection manifold pile extends approximately 0.8 m above the seabed and may pose a hazard to bottom trawl gear. Full removal eliminates this hazard. The riser holdback anchor piles are mostly buried with only a

Criterion A	Criterion B	Preferred Criterion	Rating	Justification
				small protrusion above the seabed and pose a minimal hazard to trawled fishing gear. The removal activity may result in localised displacement of other users; however, this impact will be negligible given the very low levels of activity in WA-32-L. Abandonment *in situ* will have negligible impact upon other users. Commercial fishers using trawled gear are not, nor have recently been, active in WA-32-L. Only a single pile, the water injection manifold foundation, could credibly interact with trawled fishing gear. This may result in economic losses, such as damage to gear, loss of gear, down time and loss of catch. The risk of interactions between this pile and trawled fishing gear is negligible given the lack of fish resources, lack of fishing effort, advice on nautical charts and deeply embedded status of the piles. While the risk of interactions between suction piles and trawled fishing gear is negligible, stakeholders have expressed a general preference for equipment extending above the seabed to be removed. Consequently, the full removal alternative is moderately preferred over the abandonment *in situ* alternative.

5.3 Wellheads

This section summarises the decommissioning alternatives environmental impact assessment for the wellheads. Refer to Section 2.3 for a description of this equipment group. The outcomes of the assessment for are shown in Figure 5-4 and Figure 5-5. The AHP hierarchy for this comparative assessment is shown in Figure 5-6.

Pairwise comparisons for the decommissioning alternatives for the wellheads within each criterion are provided in Table 5-3, with AHP calculations provided in Appendix C.

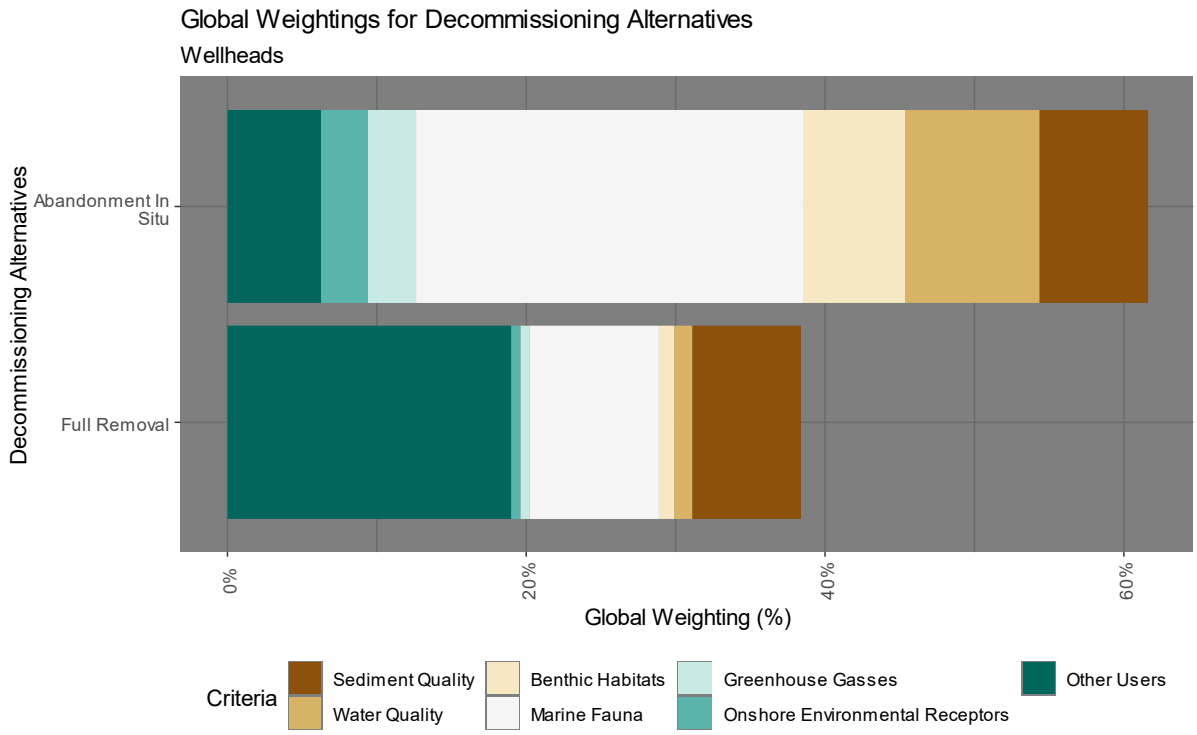


Figure 5-7: Stacked bar plot of global preference of the decommissioning alternatives for the wellheads

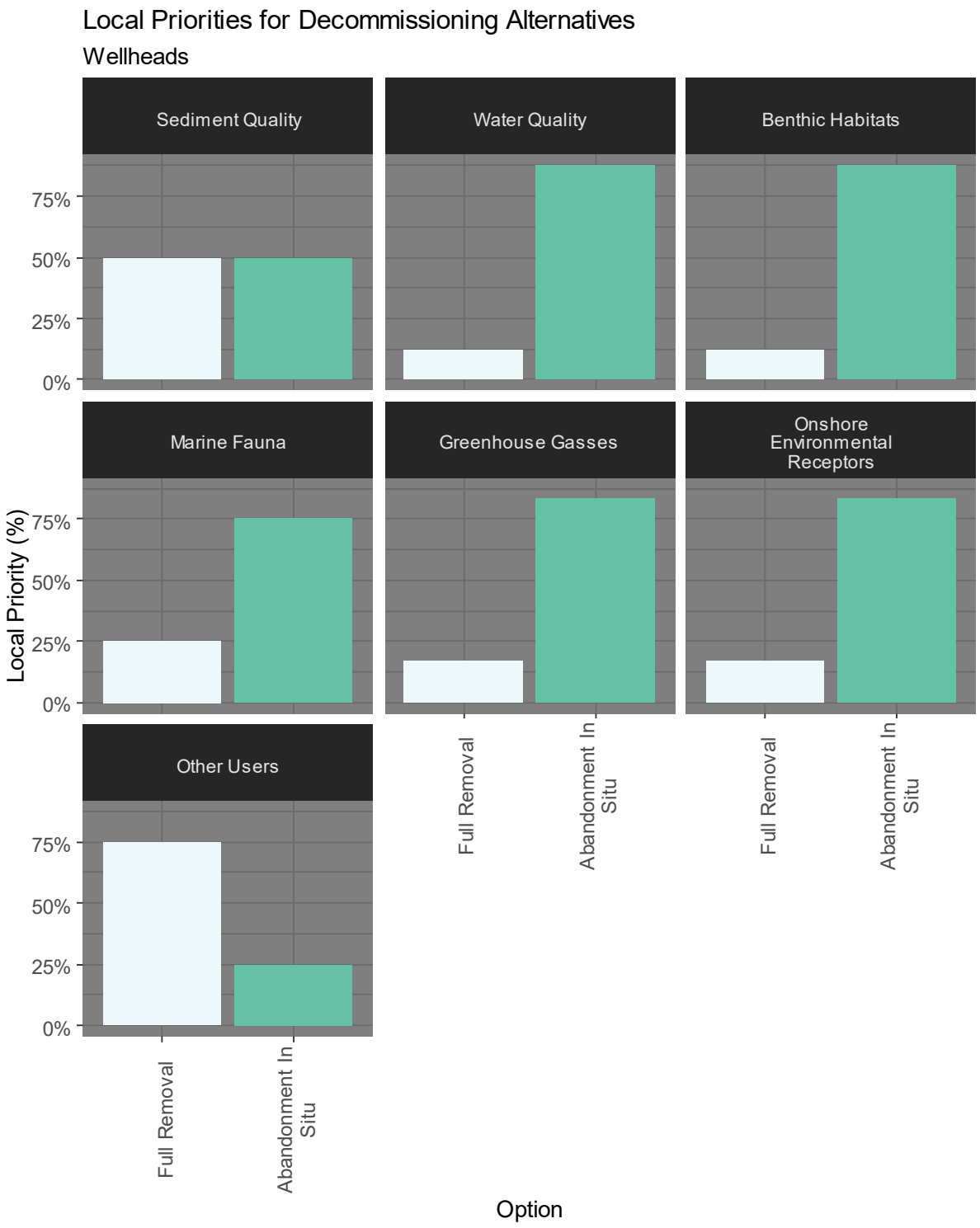


Figure 5-8: Local weighting for the decommissioning alternatives within environmental receptors for the wellheads

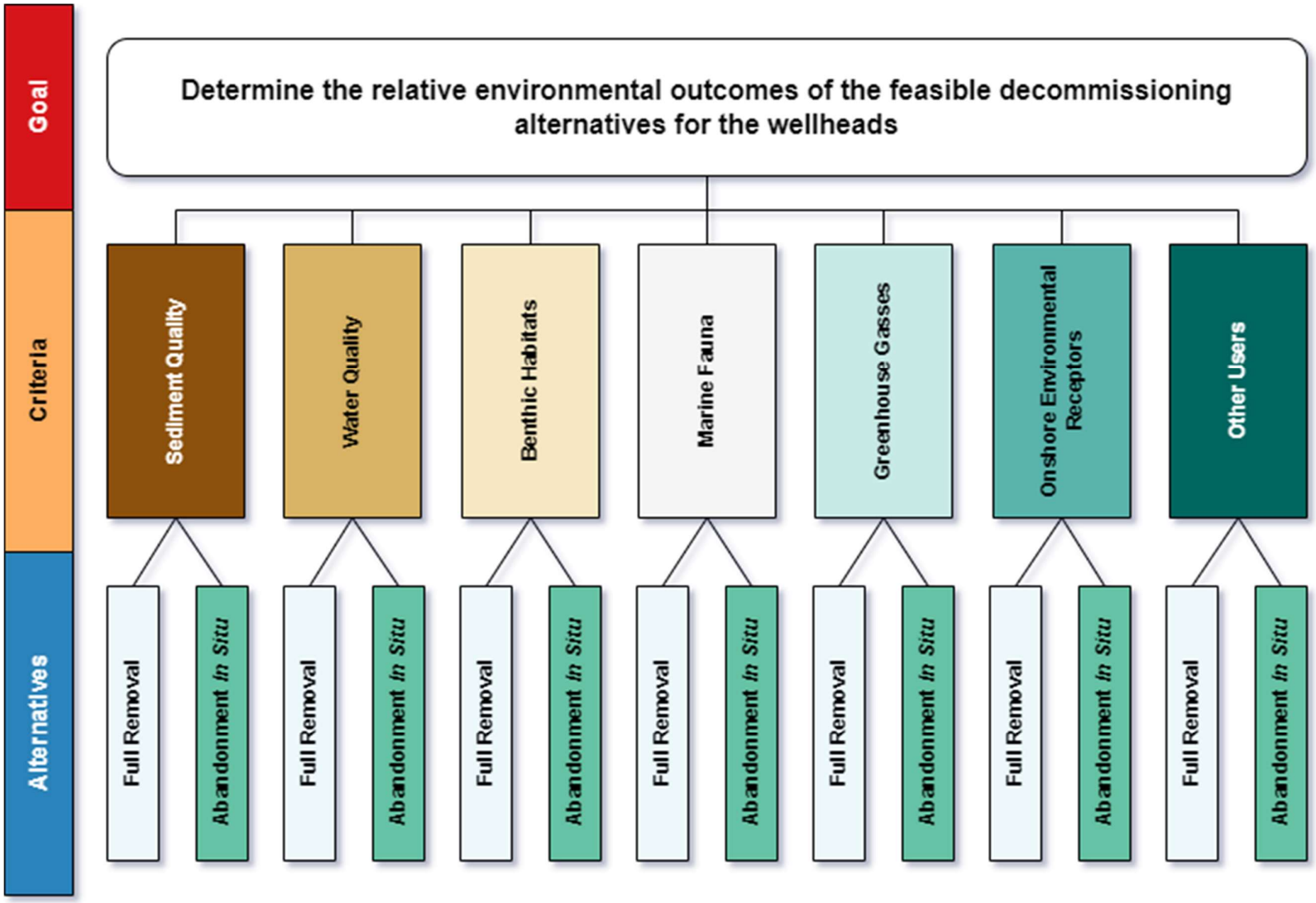


Figure 5-9: AHP hierarchy for suction piles decommissioning alternatives environmental impact assessment

Table 5-4: Pairwise comparisons of decommissioning alternatives for the suction piles

Criterion A	Criterion B	Preferred Criterion	Rating	Justification
Sediment Quality				
Full removal	Abandonment *in situ*	-	1 – Equal preference	The full removal alternative will result in substantial disturbance to sediments, remobilising sediments and leaving an uncased hole in the seabed at each wellhead location. Slumping of the sediments into the resulting hole is expected to occur following removal of the wellhead. This may remobilise contaminants in the sediments, although Cardno (2019) found concentrations of most potential contaminants were below the trigger values in the *Australian and New Zealand Guidelines for Fresh and Marine Water Quality* (Australian and New Zealand Environment and Conservation Council and Agriculture and Resource Management Council of Australia and New Zealand, 2000). Abandonment *in situ* will not result in any direct disturbance of sediments. Degradation of the wellheads following abandonment *in situ* will result in changes to the composition of sediments around the wellheads. Steel material will rust as the wellheads degrade, with rust flakes breaking away and being incorporated into the sediments. This process will result in the increase in the concentration of iron in the sediments around the wellheads. Iron is not recognised as a potential toxicant in sediments and the *Australian and New Zealand Guidelines for Fresh and Marine Water* (Commonwealth of Australia and New Zealand Government, 2018) do not provide trigger values for iron in sediments. The increased concentrations of iron in sediments are not expected to result in any biological impacts. Alloying materials are present in the mild steel in very low levels and are unlikely to result in concentrations above the guideline values in the *Australian and New Zealand Guidelines for Fresh and Marine Water* (Commonwealth of Australia and New Zealand Government, 2018). The full removal and abandonment *in situ* alternatives are equally preferred within the sediment quality criterion.
Water Quality				
Full removal	Abandonment *in situ*	B	7 – Very strong importance	Full removal of the wellheads will result in resuspension of sediments due to the removal of the wellheads and the abrasive water jet cutting method. Resuspended sediments are expected to be deposited within 100s of metres over the course of hours, while the majority of the abrasive grit used to make the cut will fall within the well. This will result in a localised, short-term decrease in water quality due to higher levels of turbidity and suspended sediments. Routine discharges form vessels undertaking the full removal alternative (e.g., grey water, sewage etc.) will result in potential changes to water quality at the discharge location. These changes to water quality will be localised around the discharge location and are only expected to be detectable within 10s to 100s of metres. Recovery to baseline conditions will occur rapidly

Criterion A	Criterion B	Preferred Criterion	Rating	Justification
				(10s of minutes) upon cessation of the discharge due to natural mixing. The environmental receptors within the environment that may be affected by these impacts to water quality are not particularly sensitive or of high environmental value. Degradation of the wellheads following abandonment *in situ* will release degradation products. As the wellheads are largely embedded in the seabed, the majority of the degradation products do not have direct pathway to the water column. The degradation products from steel have low to very low solubility, and hence will not substantially change the characteristics of seawater. No resuspension of sediments due to scouring will occur. As such, the abandonment *in situ* alternative will have no impact upon water quality. Consequently, abandonment *in situ* is very strongly preferred over full removal within the water quality criterion.
Benthic Habitats				
Full removal	Abandonment *in situ*	B	7 – Very strong importance	The full removal alternative will result in substantial disturbance to benthic habitats around the wellheads, although these habitats will be also disturbed by the equipment removal campaign to recover Christmas trees and guide bases. Removal of the wellheads will remobilise sediments and leave uncased holes in the seabed at each wellhead location. Sediment will slump into the hole, resulting in a depression in the seabed. Recovery of fauna from this disturbance is expected to occur within 10 years (Hiddink et al., 2017), although depressions in the seabed may be visible for substantially longer. The benthic habitats that would be disturbed are bare sediment habitats, which are widely represented in the region and not considered to be of high conservation value. Abandonment *in situ* will not result in any direct disturbance of benthic habitats and will preserve the habitats that have become established around the wellheads. Consequently, the abandonment *in situ* alternative is very strongly preferred over the full removal alternative within the benthic habitats criterion.
Marine Fauna				
Full removal	Abandonment *in situ*	B	5 – Strong preference	The full removal alternative will substantially disturb benthic habitats around the wellheads. This habitat is expected to host infauna and epifauna assemblages that are widely represented in the region. The wellheads are embedded; however, the tops of the wellheads extend between approximately 2 to 3 m above the mudline and hence provide hard substrate habitat. Observations of equipment in the Stybarrow field suggest there is little marine growth on the wellheads. The benthic habitats that would be disturbed are bare unconsolidated sediment habitats, which are widely represented in the region and not considered

Criterion A	Criterion B	Preferred Criterion	Rating	Justification
				to be of high conservation value. Vessel activities to implement the full removal alternatives may also impact upon fauna. The equipment is located within a pygmy blue whale migration BIA. Underwater noise from vessels using dynamic positioning may induce behavioural responses in fauna, such as migrating whales. Abandonment *in situ* will not result in any direct disturbance of benthic habitats and will preserve the habitats that have become established around the wellheads. Degradation products pose negligible risk to fauna and will be sequestered within the sediment. Consequently, the abandonment *in situ* alternative is strongly preferred over the full removal alternative within the benthic habitats criterion.
Greenhouse Gasses				
Full removal	Abandonment *in situ*	B	5 – Strong preference	The full removal alternative will generate carbon dioxide emissions from fuel combustion. Carbon dioxide is a greenhouse gas, which will result in indirect environmental impacts from climate change. These emissions are negligible in the context of offshore vessel emissions in Australia. The abandonment *in situ* alternative will not generate any greenhouse gas emissions. However, the steel in the wellheads will not be available for recycling. Consequently, the abandonment *in situ* alternative is strongly preferred to the full removal option within the greenhouse gasses criterion.
Onshore Environmental Receptors				
Full removal	Abandonment *in situ*	B	5 – Strong preference	The full removal alternative will impact upon onshore environmental receptors due to onshore disposal of the recovered wellheads. The majority of the waste material is mild steel, which is expected to be suitable for recycling. The wellheads are not suitable for reuse or repurposing. Waste management facilities are assumed to be available at a nearby port, such as Dampier. These ports have cleared land suitable for the storage and processing of the wellheads, as well as receiving vessel-based wastes. No clearing or construction of new facilities will be required. The abandonment *in situ* alternative will not generate waste requiring onshore disposal. However, the steel in the wellheads will not be available for recycling. Consequently, the abandonment *in situ* option is strongly preferred within the onshore environmental receptors criterion.

Criterion A	Criterion B	Preferred Criterion	Rating	Justification
Other Users				
Full removal	Abandonment *in situ*	A	3 – Moderate preference	The wellheads are largely embedded within the seabed and provide negligible habitat for fish that may be exploited by commercial fishers. The wellheads extend between approximately 2 to 3 m above the seabed and may pose a hazard to bottom trawl gear. Full removal eliminates this hazard. The removal activity may result in localised displacement of other users; however, this impact will be negligible given the very low levels of activity in WA-32-L. Abandonment *in situ* will have negligible impact upon other users. Commercial fishers using trawled gear are not, nor have recently been, active in WA-32-L. All of the wellheads abandoned *in situ* could credibly interact with benthic trawled fishing gear. This may result in economic losses, such as damage to gear, loss of gear, down time and loss of catch. However, the risk of interactions between wellheads and trawled fishing gear is negligible given the lack of fish resources, lack of fishing effort and advice on nautical charts. While the risk of interactions between wellheads and trawled fishing gear is negligible, stakeholders have expressed a general preference for equipment extending above the seabed to be removed. Consequently, the full removal alternative is moderately preferred over the abandonment *in situ* alternative.

6 Conclusions

The EIA identified the environmental receptors that may credible be impacted by the feasible decommissioning alternatives. Each receptor was weighted using the AHP, with marine fauna (34.6%), other users (25.3%) and sediment quality (14.5%) accounting for approximately 75% of the overall weighting of receptors.

For all candidate equipment groups, the abandonment *in situ* alternative was clearly preferred over full removal when assessed within the environmental receptors considered. Important considerations in the EIA that contribute to this result include:

- candidate equipment groups being deeply embedded in the seabed and requiring substantial seabed disturbance to recover
- materials in the candidate equipment groups will result in negligible environmental impacts as they degrade *in situ*
- the risk of interactions between the candidate equipment groups and trawled fishing gear is negligible
- activities by other users of the sea in the Stybarrow field that may interact with the equipment have not historically occurred.

The demonstration in the decommissioning alternatives EIA satisfies the requirement in the *Section 572 Maintenance and Removal of Property* (NOPSEMA, 2020) policy that any alternatives to full removal must result in equal or better environmental outcomes compared to full removal.

7 References

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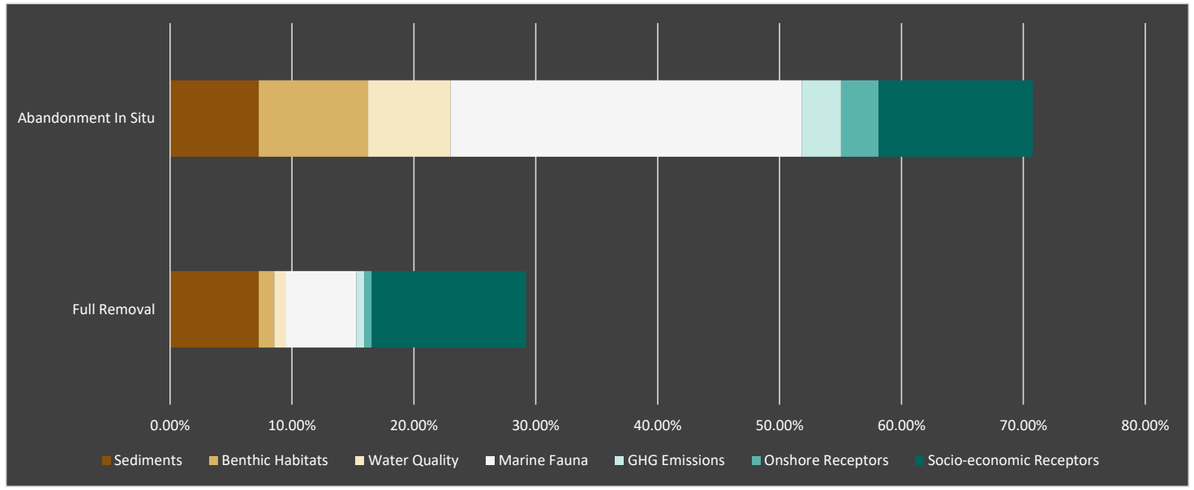
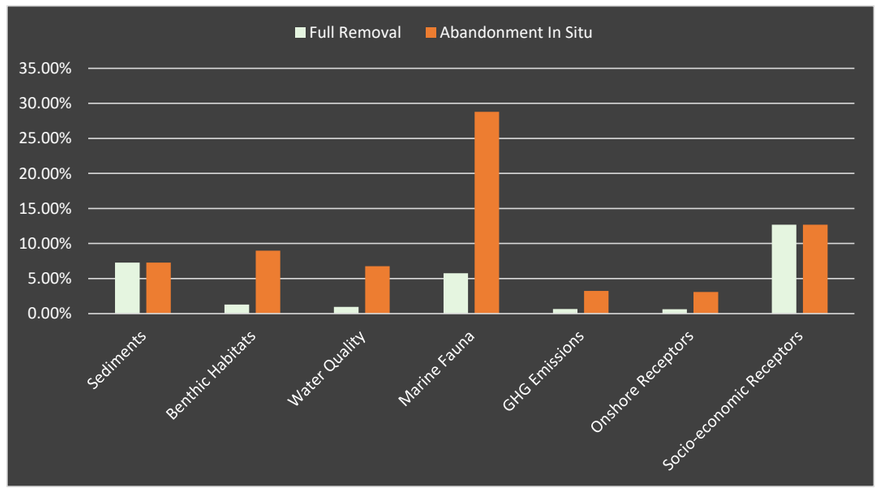
Appendix A
Analytic Hierarchy Process Detailed Calculations for the Disconnectable Turret Mooring Anchors

	Goal	Goal						
	Critera	Sediments	Water Quality	Benthic Habitats	Marine Fauna	GHG Emissions	Onshore Receptors	Socio-economic Receptors
	Criteria Priority	14.5%	10.3%	7.7%	34.6%	3.9%	3.7%	25.3%
Local Priorities	Full Removal	50.0%	12.5%	12.5%	16.7%	16.7%	16.7%	50.0%
Local Priorities	Abandonment In Situ	50.0%	87.5%	87.5%	83.3%	83.3%	83.3%	50.0%
Global Priorities	Full Removal	7.3%	1.3%	1.0%	5.8%	0.6%	0.6%	12.7%
Global Priorities	Abandonment In Situ	7.3%	9.0%	6.7%	28.8%	3.2%	3.1%	12.7%

	Sediments	Benthic Habitats	Water Quality	Marine Fauna	GHG Emissions	Onshore Receptors	Socio-economic Receptors
Full Removal	7.27%	1.28%	0.96%	5.76%	0.65%	0.62%	12.67%
Abandonment In Situ	7.27%	8.99%	6.75%	28.80%	3.23%	3.08%	12.67%





Reciprocal Array

	Sediment Quality	Water Quality	Benthic Habitats	Marine Fauna	Greenhouse Gasses	Onshore Environmental Receptors	Other Users
Sediment Quality	1	3	3	0.2	3	5	0.33
Water Quality	0.33	1	3	0.2	3	3	0.33
Benthic Habitats	0.33	0.33	1	0.2	3	3	0.33
Marine Fauna	5	5	5	1	7	7	1
Greenhouse Gasses	0.33	0.33	0.33	0.14	1	1	0.2
Onshore Environmental R	0.2	0.33	0.33	0.14	1	1	0.2
Other Users	3	3	3	1	5	5	1
Sum	10.2	13	15.7	2.89	23	25	3.4

Normalised Array

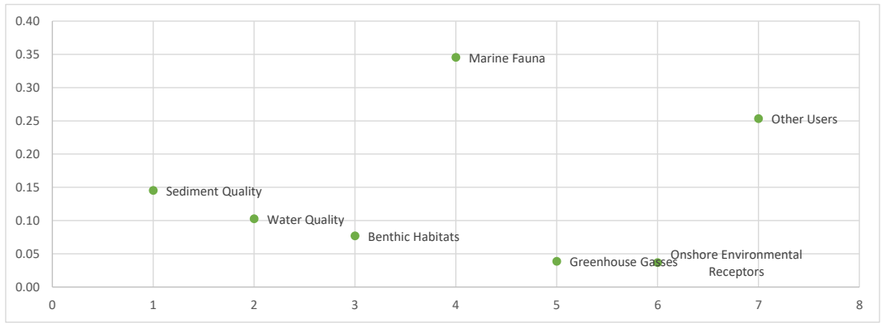
	Sediment Quality	Water Quality	Benthic Habitats	Marine Fauna	Greenhouse Gasses	Onshore Environmental Receptors	Other Users	Eigen Vector	Rank
Sediment Quality	0.1	0.23	0.19	0.07	0.13	0.2	0.1	0.15	3
Water Quality	0.03	0.08	0.19	0.07	0.13	0.12	0.1	0.10	4
Benthic Habitats	0.03	0.03	0.06	0.07	0.13	0.12	0.1	0.08	5
Marine Fauna	0.49	0.38	0.32	0.35	0.3	0.28	0.29	0.35	1
Greenhouse Gasses	0.03	0.03	0.02	0.05	0.04	0.04	0.06	0.04	6
Onshore Environmental R	0.02	0.03	0.02	0.05	0.04	0.04	0.06	0.04	7
Other Users	0.29	0.23	0.19	0.35	0.22	0.2	0.29	0.25	2

Consistency Index

Principal Eigen Value	7.7
N	7
Consistency Index	0.12
Random Index (n=7)	1.32
Consistency Ratio	9%

Summary Tab

Statement	Ranking	Switch	Rank	Commentary
Sediment Quality is of moderate importance compared to Water Quality	moderate importance	No	3	Sediment important - mercury contamination, change name to sediment quality
Sediment Quality is of moderate importance compared to Benthic Habitats	moderate importance	No	3	
Marine Fauna is of strong importance compared to Sediment Quality	strong importance	Yes	0.2	
Sediment Quality is of moderate importance compared to Greenhouse Gasses	moderate importance	No	3	
Sediment Quality is of strong importance compared to Onshore Environmental Receptors	strong importance	No	5	
Other Users is of moderate importance compared to Sediment Quality	moderate importance	Yes	0.33333	
Water Quality is of moderate importance compared to Benthic Habitats	moderate importance	No	3	
Marine Fauna is of strong importance compared to Water Quality	strong importance	Yes	0.2	
Water Quality is of moderate importance compared to Greenhouse Gasses	moderate importance	No	3	
Water Quality is of moderate importance compared to Onshore Environmental Receptors	moderate importance	No	3	
Other Users is of moderate importance compared to Water Quality	moderate importance	Yes	0.33333	
Marine Fauna is of strong importance compared to Benthic Habitats	strong importance	Yes	0.2	
Benthic Habitats is of moderate importance compared to Greenhouse Gasses	moderate importance	No	3	
Benthic Habitats is of moderate importance compared to Onshore Environmental Receptors	moderate importance	No	3	
Other Users is of moderate importance compared to Benthic Habitats	moderate importance	Yes	0.33333	
Marine Fauna is of very strong importance compared to Greenhouse Gasses	very strong importance	No	7	
Marine Fauna is of very strong importance compared to Onshore Environmental Receptors	very strong importance	No	7	
Marine Fauna is of equal importance compared to Other Users	equal importance	No	1	
Greenhouse Gasses is of equal importance compared to Onshore Environmental Receptors	equal importance	No	1	
Other Users is of strong importance compared to Greenhouse Gasses	strong importance	Yes	0.2	
Other Users is of strong importance compared to Onshore Environmental Receptors	strong importance	Yes	0.2	



Reciprocal Array

	Full Removal	Abandonment In Situ
Full Removal	1	1
Abandonment In Situ	1	1
Sum	2	2

Normalised Array

	Full Removal	Abandonment In Situ	Eigen Vector	Rank
Full Removal	0.5	0.5	0.50	1
Abandonment In Situ	0.5	0.5	0.50	1

Consistency Index

Principal Eigen Value	####
N	2
Consistency Index	####
Random Index (n=2)	0
Consistency Ratio	####

Statement	Ranking	Switch	Rank	Commentary
Abandonment In Situ is of equal importance compared to Full Removal	equal importance	Yes	1	

Summary Tab

Reciprocal Array

	Full Removal	Abandonment In Situ
Full Removal	1	0.14
Abandonment In Situ	7	1
Sum	8	1.14

Normalised Array

	Full Removal	Abandonment In Situ	Eigen Vector	Rank
Full Removal	0.13	0.13	0.13	2
Abandonment In Situ	0.88	0.88	0.88	1

Consistency Index

Principal Eigen Value	####
N	2
Consistency Index	####
Random Index (n=2)	0
Consistency Ratio	####

Statement	Ranking	Switch	Rank	Commentary
Abandonment In Situ is of very strong importance compared to Full Removal	very strong importance	Yes	0.1429	

Summary Tab

Reciprocal Array

	Full Removal	Abandonment In Situ
Full Removal	1	0.14
Abandonment In Situ	7	1
Sum	8	1.14

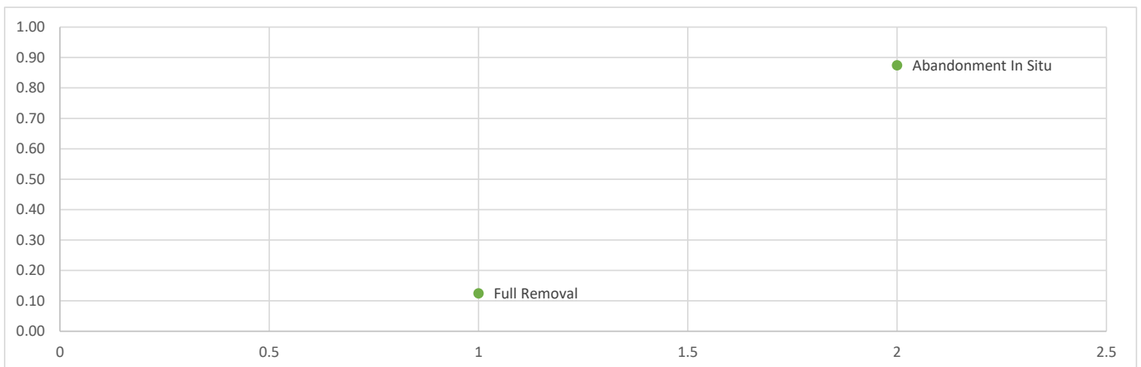
Normalised Array

	Full Removal	Abandonment In Situ	Eigen Vector	Rank
Full Removal	0.13	0.13	0.13	2
Abandonment In Situ	0.88	0.88	0.88	1

Consistency Index

Principal Eigen Value	####
N	2
Consistency Index	####
Random Index (n=2)	0
Consistency Ratio	####

Statement	Ranking	Switch	Rank	Commentary
Abandonment In Situ is of very strong importance compared to Full Removal	very strong importance	Yes	0.1429	



Summary Tab

Reciprocal Array

	Full Removal	Abandonment In Situ
Full Removal	1	0.2
Abandonment In Situ	5	1
Sum	6	1.2

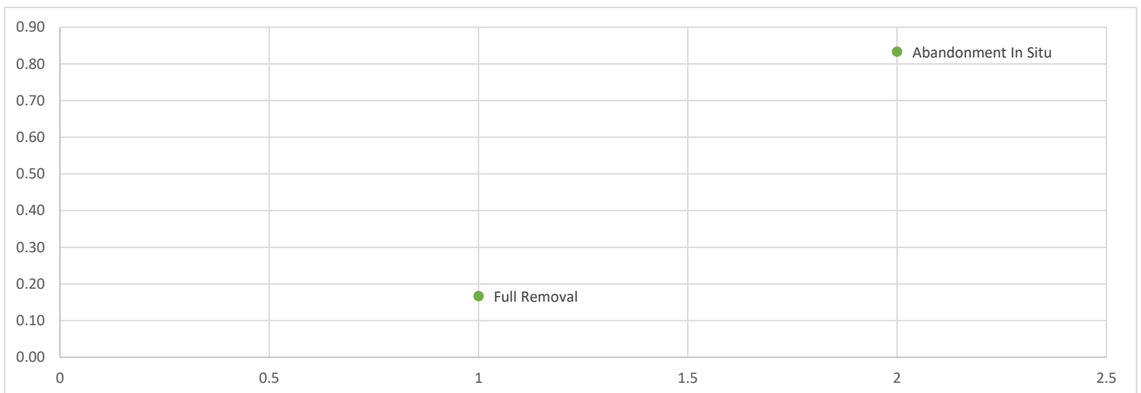
Normalised Array

	Full Removal	Abandonment In Situ	Eigen Vector	Rank
Full Removal	0.17	0.17	0.17	2
Abandonment In Situ	0.83	0.83	0.83	1

Consistency Index

Principal Eigen Value	####
N	2
Consistency Index	####
Random Index (n=2)	0
Consistency Ratio	####

Statement	Ranking	Switch	Rank	Commentary
Abandonment In Situ is of strong importance compared to Full Removal	strong importance	Yes	0.2	



Summary Tab

Reciprocal Array

	Full Removal	Abandonment In Situ
Full Removal	1	0.2
Abandonment In Situ	5	1
Sum	6	1.2

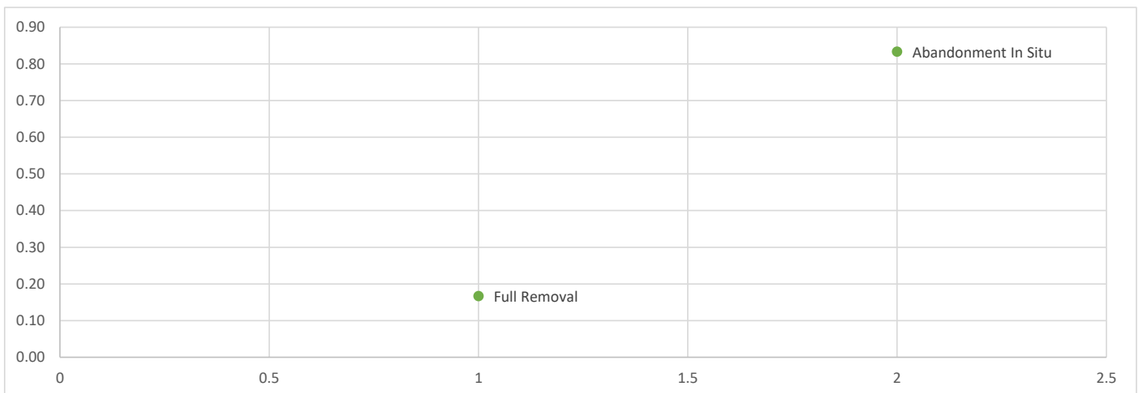
Normalised Array

	Full Removal	Abandonment In Situ	Eigen Vector	Rank
Full Removal	0.17	0.17	0.17	2
Abandonment In Situ	0.83	0.83	0.83	1

Consistency Index

Principal Eigen Value	####
N	2
Consistency Index	####
Random Index (n=2)	0
Consistency Ratio	####

Statement	Ranking	Switch	Rank	Commentary
Abandonment In Situ is of strong importance compared to Full Removal	strong importance	Yes	0.2	



Summary Tab

Reciprocal Array

	Full Removal	Abandonment In Situ
Full Removal	1	0.2
Abandonment In Situ	5	1
Sum	6	1.2

Normalised Array

	Full Removal	Abandonment In Situ	Eigen Vector	Rank
Full Removal	0.17	0.17	0.17	2
Abandonment In Situ	0.83	0.83	0.83	1

Consistency Index

Principal Eigen Value	####
N	2
Consistency Index	####
Random Index (n=2)	0
Consistency Ratio	####

Statement	Ranking	Switch	Rank	Commentary
Abandonment In Situ is of strong importance compared to Full Removal	strong importance	Yes	0.2	

Summary Tab

Reciprocal Array

	Full Removal	Abandonment In Situ
Full Removal	1	1
Abandonment In Situ	1	1
Sum	2	2

Normalised Array

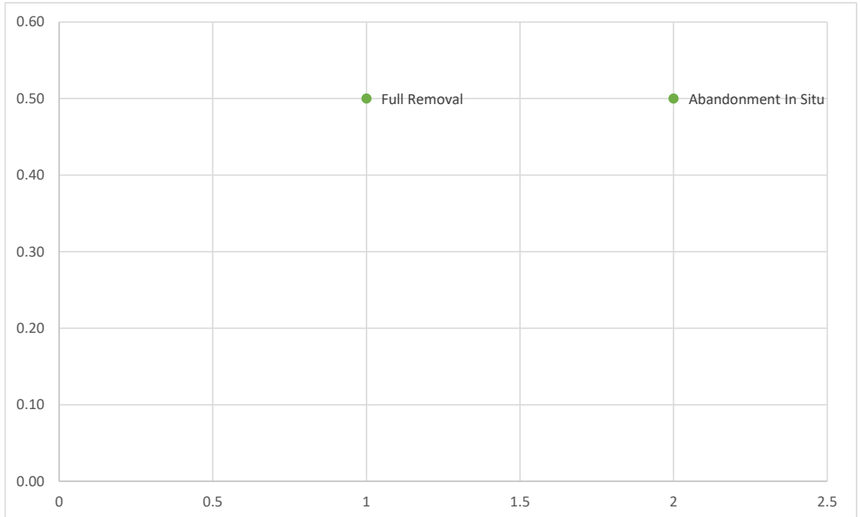
	Full Removal	Abandonment In Situ	Eigen Vector	Rank
Full Removal	0.5	0.5	0.50	1
Abandonment In Situ	0.5	0.5	0.50	1

Consistency Index

Principal Eigen Value	####
N	2
Consistency Index	####
Random Index (n=2)	0
Consistency Ratio	####

Summary Tab

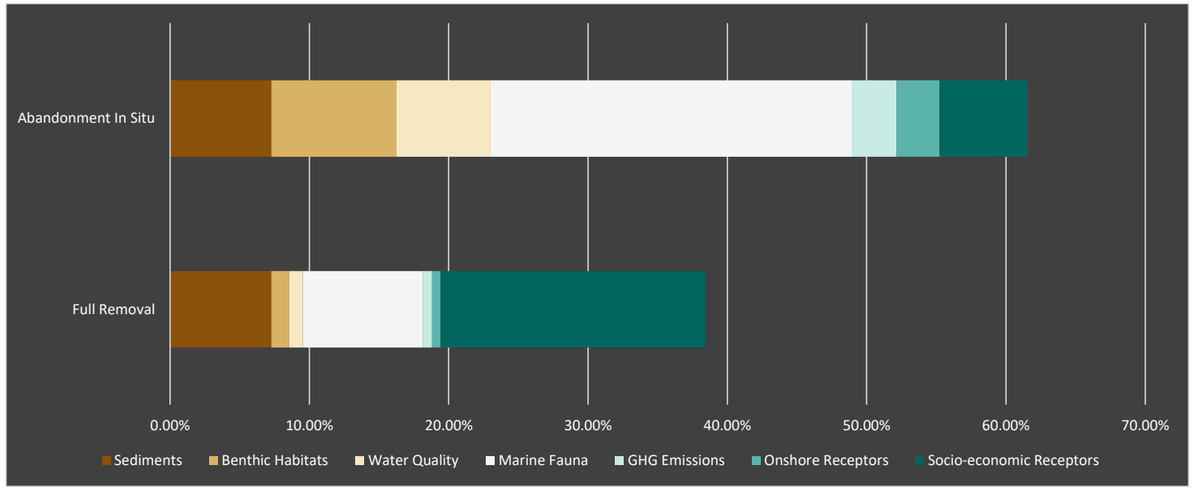
Statement	Ranking	Switch	Rank	Commentary
Full removal is of equal importance compared to Abandonment In Situ	equal importance	No	1	

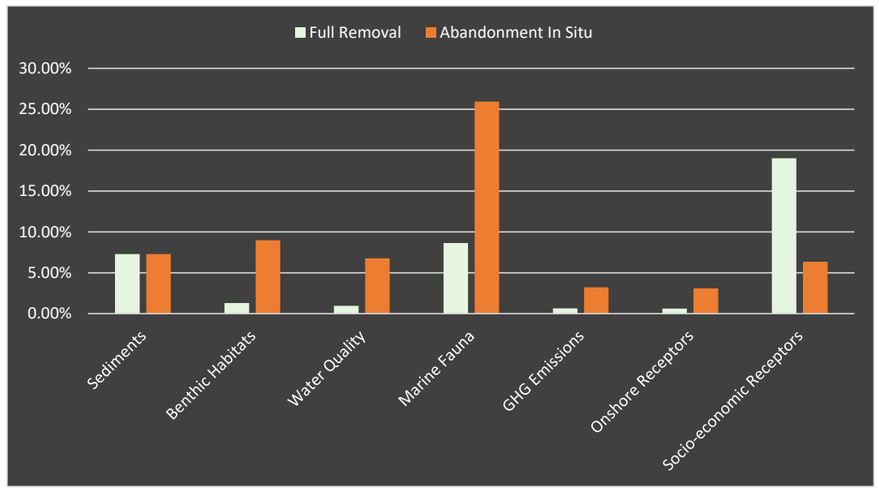


Appendix B
Analytic Hierarchy Process Detailed Calculations for the Suction Piles

	Goal	Goal						
	Critera	Sediments	Water Quality	Benthic Habitats	Marine Fauna	GHG Emissions	Onshore Receptors	Socio-economic Receptors
	Criteria Priority	14.5%	10.3%	7.7%	34.6%	3.9%	3.7%	25.3%
Local Priorities	Full Removal	50.0%	12.5%	12.5%	25.0%	16.7%	16.7%	75.0%
Local Priorities	Abandonment In Situ	50.0%	87.5%	87.5%	75.0%	83.3%	83.3%	25.0%
Global Priorities	Full Removal	7.3%	1.3%	1.0%	8.6%	0.6%	0.6%	19.0%
Global Priorities	Abandonment In Situ	7.3%	9.0%	6.7%	25.9%	3.2%	3.1%	6.3%

	Sediments	Benthic Habitats	Water Quality	Marine Fauna	GHG Emissions	Onshore Receptors	Socio-economic Receptors
Full Removal	7.27%	1.28%	0.96%	8.64%	0.65%	0.62%	19.01%
Abandonment In Situ	7.27%	8.99%	6.75%	25.92%	3.23%	3.08%	6.34%





Reciprocal Array

	Sediment Quality	Water Quality	Benthic Habitats	Marine Fauna	Greenhouse Gasses	Onshore Environmental Receptors	Other Users
Sediment Quality	1	3	3	0.2	3	5	0.33
Water Quality	0.33	1	3	0.2	3	3	0.33
Benthic Habitats	0.33	0.33	1	0.2	3	3	0.33
Marine Fauna	5	5	5	1	7	7	1
Greenhouse Gasses	0.33	0.33	0.33	0.14	1	1	0.2
Onshore Environmental R	0.2	0.33	0.33	0.14	1	1	0.2
Other Users	3	3	3	1	5	5	1
Sum	10.2	13	15.7	2.89	23	25	3.4

Normalised Array

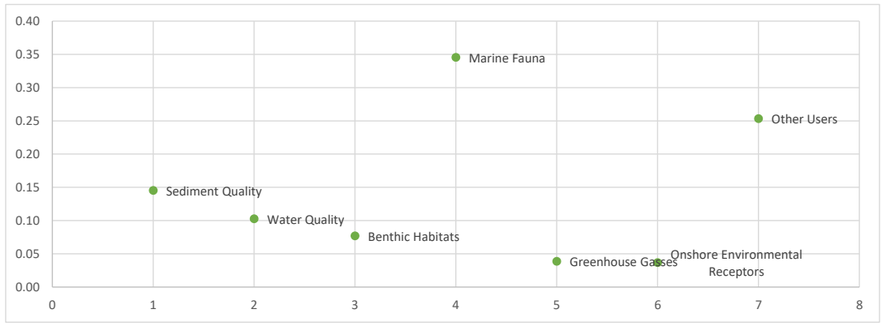
	Sediment Quality	Water Quality	Benthic Habitats	Marine Fauna	Greenhouse Gasses	Onshore Environmental Receptors	Other Users	Eigen Vector	Rank
Sediment Quality	0.1	0.23	0.19	0.07	0.13	0.2	0.1	0.15	3
Water Quality	0.03	0.08	0.19	0.07	0.13	0.12	0.1	0.10	4
Benthic Habitats	0.03	0.03	0.06	0.07	0.13	0.12	0.1	0.08	5
Marine Fauna	0.49	0.38	0.32	0.35	0.3	0.28	0.29	0.35	1
Greenhouse Gasses	0.03	0.03	0.02	0.05	0.04	0.04	0.06	0.04	6
Onshore Environmental R	0.02	0.03	0.02	0.05	0.04	0.04	0.06	0.04	7
Other Users	0.29	0.23	0.19	0.35	0.22	0.2	0.29	0.25	2

Consistency Index

Principal Eigen Value	7.7
N	7
Consistency Index	0.12
Random Index (n=7)	1.32
Consistency Ratio	9%

Summary Tab

Statement	Ranking	Switch	Rank	Commentary
Sediment Quality is of moderate importance compared to Water Quality	moderate importance	No	3	Sediment important - mercury contamination, change name to sediment quality
Sediment Quality is of moderate importance compared to Benthic Habitats	moderate importance	No	3	
Marine Fauna is of strong importance compared to Sediment Quality	strong importance	Yes	0.2	
Sediment Quality is of moderate importance compared to Greenhouse Gasses	moderate importance	No	3	
Sediment Quality is of strong importance compared to Onshore Environmental Receptors	strong importance	No	5	
Other Users is of moderate importance compared to Sediment Quality	moderate importance	Yes	0.33333	
Water Quality is of moderate importance compared to Benthic Habitats	moderate importance	No	3	
Marine Fauna is of strong importance compared to Water Quality	strong importance	Yes	0.2	
Water Quality is of moderate importance compared to Greenhouse Gasses	moderate importance	No	3	
Water Quality is of moderate importance compared to Onshore Environmental Receptors	moderate importance	No	3	
Other Users is of moderate importance compared to Water Quality	moderate importance	Yes	0.33333	
Marine Fauna is of strong importance compared to Benthic Habitats	strong importance	Yes	0.2	
Benthic Habitats is of moderate importance compared to Greenhouse Gasses	moderate importance	No	3	
Benthic Habitats is of moderate importance compared to Onshore Environmental Receptors	moderate importance	No	3	
Other Users is of moderate importance compared to Benthic Habitats	moderate importance	Yes	0.33333	
Marine Fauna is of very strong importance compared to Greenhouse Gasses	very strong importance	No	7	
Marine Fauna is of very strong importance compared to Onshore Environmental Receptors	very strong importance	No	7	
Marine Fauna is of equal importance compared to Other Users	equal importance	No	1	
Greenhouse Gasses is of equal importance compared to Onshore Environmental Receptors	equal importance	No	1	
Other Users is of strong importance compared to Greenhouse Gasses	strong importance	Yes	0.2	
Other Users is of strong importance compared to Onshore Environmental Receptors	strong importance	Yes	0.2	



Reciprocal Array

	Full Removal	Abandonment In Situ
Full Removal	1	1
Abandonment In Situ	1	1
Sum	2	2

Normalised Array

	Full Removal	Abandonment In Situ	Eigen Vector	Rank
Full Removal	0.5	0.5	0.50	1
Abandonment In Situ	0.5	0.5	0.50	1

Consistency Index

Principal Eigen Value	####
N	2
Consistency Index	####
Random Index (n=2)	0
Consistency Ratio	####

Statement	Ranking	Switch	Rank	Commentary
Abandonment In Situ is of equal importance compared to Full Removal	equal importance	Yes	1	

Summary Tab

Reciprocal Array

	Full Removal	Abandonment In Situ
Full Removal	1	0.14
Abandonment In Situ	7	1
Sum	8	1.14

Normalised Array

	Full Removal	Abandonment In Situ	Eigen Vector	Rank
Full Removal	0.13	0.13	0.13	2
Abandonment In Situ	0.88	0.88	0.88	1

Consistency Index

Principal Eigen Value	####
N	2
Consistency Index	####
Random Index (n=2)	0
Consistency Ratio	####

Statement	Ranking	Switch	Rank	Commentary
Abandonment In Situ is of very strong importance compared to Full Removal	very strong importance	Yes	0.1429	

Summary Tab

Reciprocal Array

	Full Removal	Abandonment In Situ
Full Removal	1	0.14
Abandonment In Situ	7	1
Sum	8	1.14

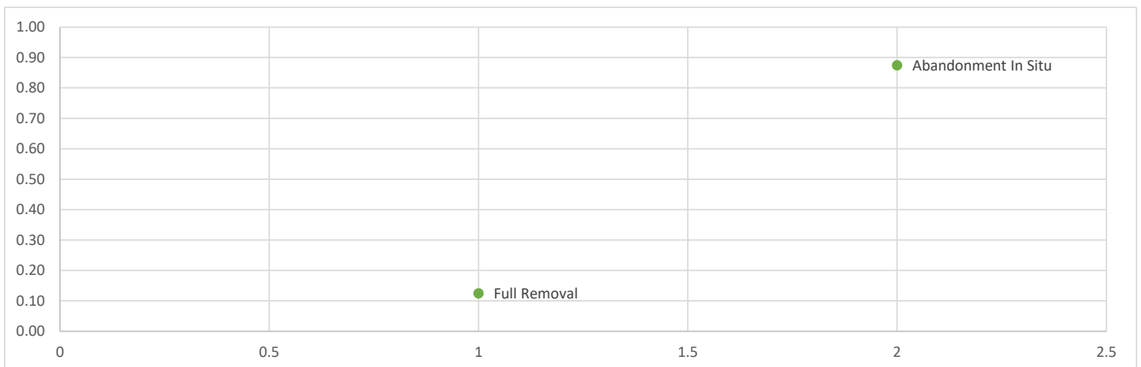
Normalised Array

	Full Removal	Abandonment In Situ	Eigen Vector	Rank
Full Removal	0.13	0.13	0.13	2
Abandonment In Situ	0.88	0.88	0.88	1

Consistency Index

Principal Eigen Value	####
N	2
Consistency Index	####
Random Index (n=2)	0
Consistency Ratio	####

Statement	Ranking	Switch	Rank	Commentary
Abandonment In Situ is of very strong importance compared to Full Removal	very strong importance	Yes	0.1429	



Summary Tab

Reciprocal Array

	Full Removal	Abandonment In Situ
Full Removal	1	0.33
Abandonment In Situ	3	1
Sum	4	1.33

Normalised Array

	Full Removal	Abandonment In Situ	Eigen Vector	Rank
Full Removal	0.25	0.25	0.25	2
Abandonment In Situ	0.75	0.75	0.75	1

Consistency Index

Principal Eigen Value	####
N	2
Consistency Index	####
Random Index (n=2)	0
Consistency Ratio	####

Statement	Ranking	Switch	Rank	Commentary
Abandonment In Situ is of moderate importance compared to Full Removal	moderate importance	Yes	0.3333	

Summary Tab

Reciprocal Array

	Full Removal	Abandonment In Situ
Full Removal	1	0.2
Abandonment In Situ	5	1
Sum	6	1.2

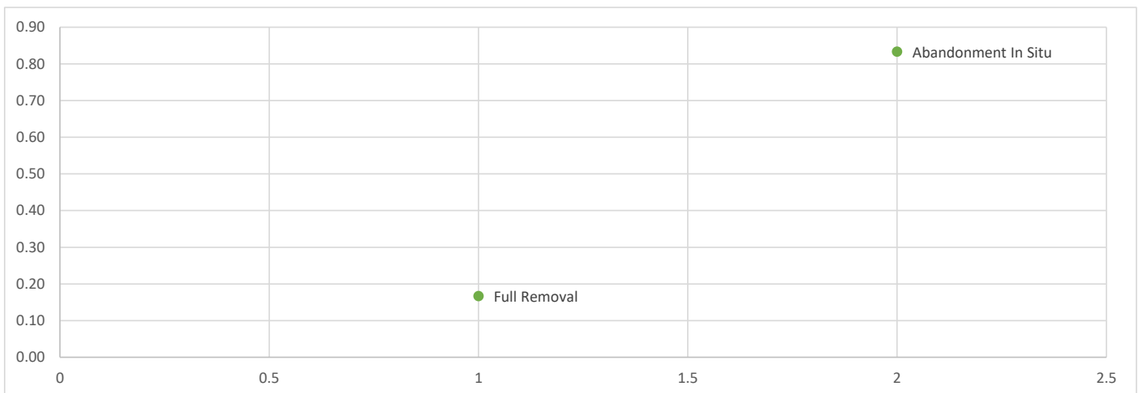
Normalised Array

	Full Removal	Abandonment In Situ	Eigen Vector	Rank
Full Removal	0.17	0.17	0.17	2
Abandonment In Situ	0.83	0.83	0.83	1

Consistency Index

Principal Eigen Value	####
N	2
Consistency Index	####
Random Index (n=2)	0
Consistency Ratio	####

Statement	Ranking	Switch	Rank	Commentary
Abandonment In Situ is of strong importance compared to Full Removal	strong importance	Yes	0.2	



Summary Tab

Reciprocal Array

	Full Removal	Abandonment In Situ
Full Removal	1	0.2
Abandonment In Situ	5	1
Sum	6	1.2

Normalised Array

	Full Removal	Abandonment In Situ	Eigen Vector	Rank
Full Removal	0.17	0.17	0.17	2
Abandonment In Situ	0.83	0.83	0.83	1

Consistency Index

Principal Eigen Value	####
N	2
Consistency Index	####
Random Index (n=2)	0
Consistency Ratio	####

Statement	Ranking	Switch	Rank	Commentary
Abandonment In Situ is of strong importance compared to Full Removal	strong importance	Yes	0.2	

Summary Tab

Reciprocal Array

	Full Removal	Abandonment In Situ
Full Removal	1	3
Abandonment In Situ	0.33	1
Sum	1.33	4

Normalised Array

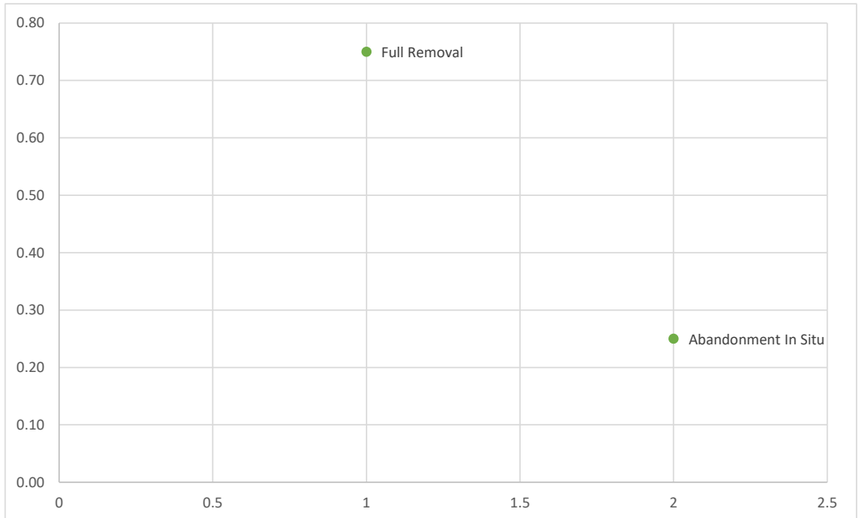
	Full Removal	Abandonment In Situ	Eigen Vector	Rank
Full Removal	0.75	0.75	0.75	1
Abandonment In Situ	0.25	0.25	0.25	2

Consistency Index

Principal Eigen Value	####
N	2
Consistency Index	####
Random Index (n=2)	0
Consistency Ratio	####

Summary Tab

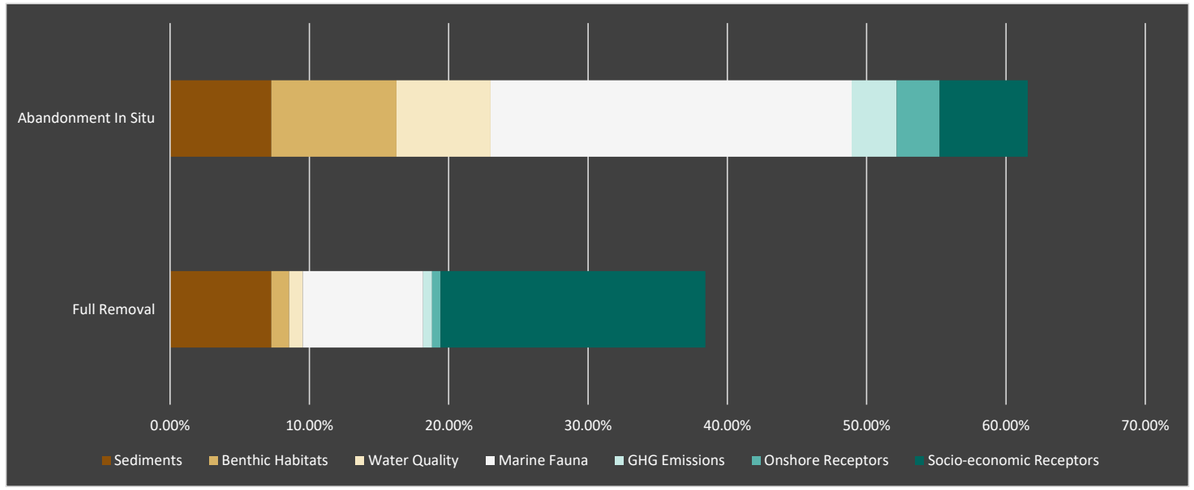
Statement	Ranking	Switch	Rank	Commentary
Full removal is of moderate importance compared to Abandonment In Situ	moderate importance	No	3	

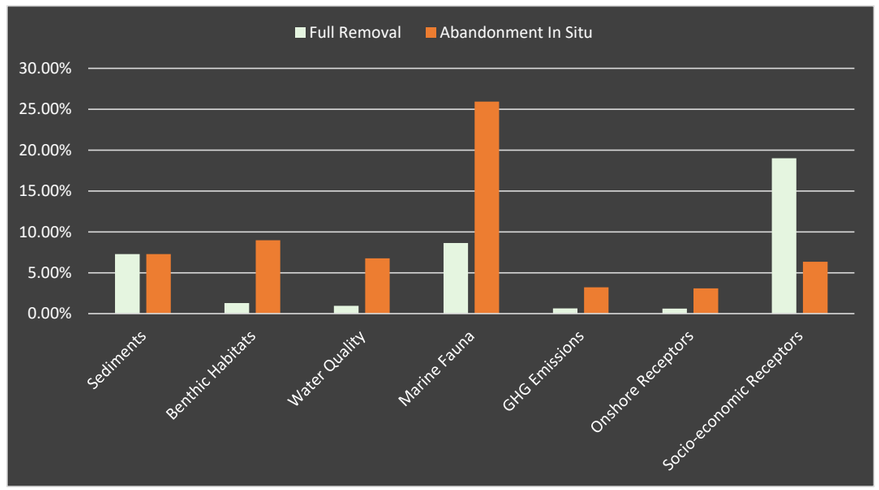


Appendix C
Analytic Hierarchy Process Detailed Calculations for the Wellheads

	Goal	Goal						
	Critera	Sediments	Water Quality	Benthic Habitats	Marine Fauna	GHG Emissions	Onshore Receptors	Socio-economic Receptors
	Criteria Priority	14.5%	10.3%	7.7%	34.6%	3.9%	3.7%	25.3%
Local Priorities	Full Removal	50.0%	12.5%	12.5%	25.0%	16.7%	16.7%	75.0%
Local Priorities	Abandonment In Situ	50.0%	87.5%	87.5%	75.0%	83.3%	83.3%	25.0%
Global Priorities	Full Removal	7.3%	1.3%	1.0%	8.6%	0.6%	0.6%	19.0%
Global Priorities	Abandonment In Situ	7.3%	9.0%	6.7%	25.9%	3.2%	3.1%	6.3%

	Sediments	Benthic Habitats	Water Quality	Marine Fauna	GHG Emissions	Onshore Receptors	Socio-economic Receptors
Full Removal	7.27%	1.28%	0.96%	8.64%	0.65%	0.62%	19.01%
Abandonment In Situ	7.27%	8.99%	6.75%	25.92%	3.23%	3.08%	6.34%





Reciprocal Array

	Sediment Quality	Water Quality	Benthic Habitats	Marine Fauna	Greenhouse Gasses	Onshore Environmental Receptors	Other Users
Sediment Quality	1	3	3	0.2	3	5	0.33
Water Quality	0.33	1	3	0.2	3	3	0.33
Benthic Habitats	0.33	0.33	1	0.2	3	3	0.33
Marine Fauna	5	5	5	1	7	7	1
Greenhouse Gasses	0.33	0.33	0.33	0.14	1	1	0.2
Onshore Environmental R	0.2	0.33	0.33	0.14	1	1	0.2
Other Users	3	3	3	1	5	5	1
Sum	10.2	13	15.7	2.89	23	25	3.4

Normalised Array

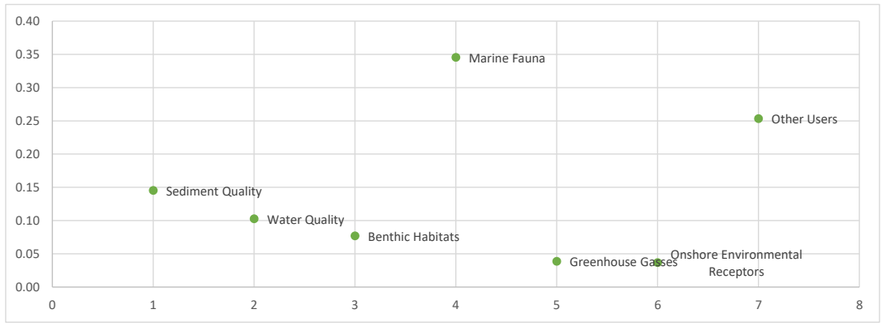
	Sediment Quality	Water Quality	Benthic Habitats	Marine Fauna	Greenhouse Gasses	Onshore Environmental Receptors	Other Users	Eigen Vector	Rank
Sediment Quality	0.1	0.23	0.19	0.07	0.13	0.2	0.1	0.15	3
Water Quality	0.03	0.08	0.19	0.07	0.13	0.12	0.1	0.10	4
Benthic Habitats	0.03	0.03	0.06	0.07	0.13	0.12	0.1	0.08	5
Marine Fauna	0.49	0.38	0.32	0.35	0.3	0.28	0.29	0.35	1
Greenhouse Gasses	0.03	0.03	0.02	0.05	0.04	0.04	0.06	0.04	6
Onshore Environmental R	0.02	0.03	0.02	0.05	0.04	0.04	0.06	0.04	7
Other Users	0.29	0.23	0.19	0.35	0.22	0.2	0.29	0.25	2

Consistency Index

Principal Eigen Value	7.7
N	7
Consistency Index	0.12
Random Index (n=7)	1.32
Consistency Ratio	9%

Summary Tab

Statement	Ranking	Switch	Rank	Commentary
Sediment Quality is of moderate importance compared to Water Quality	moderate importance	No	3	Sediment important - mercury contamination, change name to sediment quality
Sediment Quality is of moderate importance compared to Benthic Habitats	moderate importance	No	3	
Marine Fauna is of strong importance compared to Sediment Quality	strong importance	Yes	0.2	
Sediment Quality is of moderate importance compared to Greenhouse Gasses	moderate importance	No	3	
Sediment Quality is of strong importance compared to Onshore Environmental Receptors	strong importance	No	5	
Other Users is of moderate importance compared to Sediment Quality	moderate importance	Yes	0.33333	
Water Quality is of moderate importance compared to Benthic Habitats	moderate importance	No	3	
Marine Fauna is of strong importance compared to Water Quality	strong importance	Yes	0.2	
Water Quality is of moderate importance compared to Greenhouse Gasses	moderate importance	No	3	
Water Quality is of moderate importance compared to Onshore Environmental Receptors	moderate importance	No	3	
Other Users is of moderate importance compared to Water Quality	moderate importance	Yes	0.33333	
Marine Fauna is of strong importance compared to Benthic Habitats	strong importance	Yes	0.2	
Benthic Habitats is of moderate importance compared to Greenhouse Gasses	moderate importance	No	3	
Benthic Habitats is of moderate importance compared to Onshore Environmental Receptors	moderate importance	No	3	
Other Users is of moderate importance compared to Benthic Habitats	moderate importance	Yes	0.33333	
Marine Fauna is of very strong importance compared to Greenhouse Gasses	very strong importance	No	7	
Marine Fauna is of very strong importance compared to Onshore Environmental Receptors	very strong importance	No	7	
Marine Fauna is of equal importance compared to Other Users	equal importance	No	1	
Greenhouse Gasses is of equal importance compared to Onshore Environmental Receptors	equal importance	No	1	
Other Users is of strong importance compared to Greenhouse Gasses	strong importance	Yes	0.2	
Other Users is of strong importance compared to Onshore Environmental Receptors	strong importance	Yes	0.2	



Reciprocal Array

	Full Removal	Abandonment In Situ
Full Removal	1	1
Abandonment In Situ	1	1
Sum	2	2

Normalised Array

	Full Removal	Abandonment In Situ	Eigen Vector	Rank
Full Removal	0.5	0.5	0.50	1
Abandonment In Situ	0.5	0.5	0.50	1

Consistency Index

Principal Eigen Value	####
N	2
Consistency Index	####
Random Index (n=2)	0
Consistency Ratio	####

Statement	Ranking	Switch	Rank	Commentary
Abandonment In Situ is of equal importance compared to Full Removal	equal importance	Yes	1	

Summary Tab

Reciprocal Array

	Full Removal	Abandonment In Situ
Full Removal	1	0.14
Abandonment In Situ	7	1
Sum	8	1.14

Normalised Array

	Full Removal	Abandonment In Situ	Eigen Vector	Rank
Full Removal	0.13	0.13	0.13	2
Abandonment In Situ	0.88	0.88	0.88	1

Consistency Index

Principal Eigen Value	####
N	2
Consistency Index	####
Random Index (n=2)	0
Consistency Ratio	####

Statement	Ranking	Switch	Rank	Commentary
Abandonment In Situ is of very strong importance compared to Full Removal	very strong importance	Yes	0.1429	

Summary Tab

Reciprocal Array

	Full Removal	Abandonment In Situ
Full Removal	1	0.14
Abandonment In Situ	7	1
Sum	8	1.14

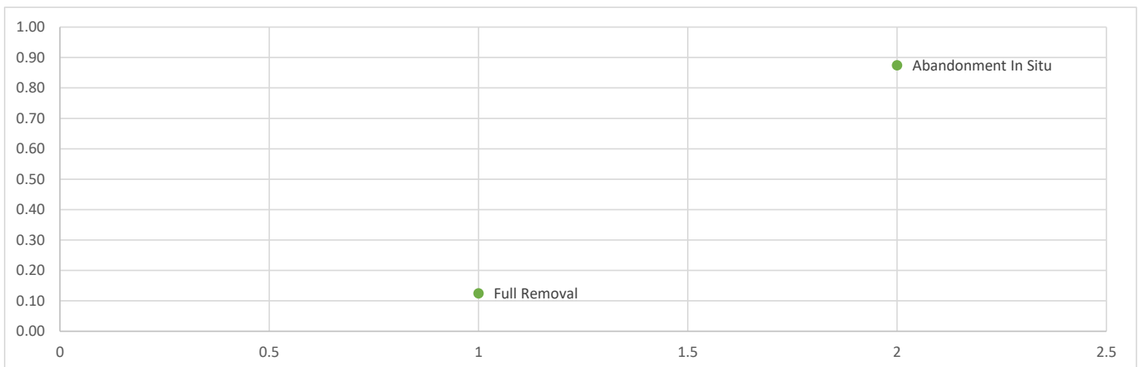
Normalised Array

	Full Removal	Abandonment In Situ	Eigen Vector	Rank
Full Removal	0.13	0.13	0.13	2
Abandonment In Situ	0.88	0.88	0.88	1

Consistency Index

Principal Eigen Value	####
N	2
Consistency Index	####
Random Index (n=2)	0
Consistency Ratio	####

Statement	Ranking	Switch	Rank	Commentary
Abandonment In Situ is of very strong importance compared to Full Removal	very strong importance	Yes	0.1429	



Summary Tab

Reciprocal Array

	Full Removal	Abandonment In Situ
Full Removal	1	0.33
Abandonment In Situ	3	1
Sum	4	1.33

Normalised Array

	Full Removal	Abandonment In Situ	Eigen Vector	Rank
Full Removal	0.25	0.25	0.25	2
Abandonment In Situ	0.75	0.75	0.75	1

Consistency Index

Principal Eigen Value	####
N	2
Consistency Index	####
Random Index (n=2)	0
Consistency Ratio	####

Statement	Ranking	Switch	Rank	Commentary
Abandonment In Situ is of moderate importance compared to Full Removal	moderate importance	Yes	0.3333	

Summary Tab

Reciprocal Array

	Full Removal	Abandonment In Situ
Full Removal	1	0.2
Abandonment In Situ	5	1
Sum	6	1.2

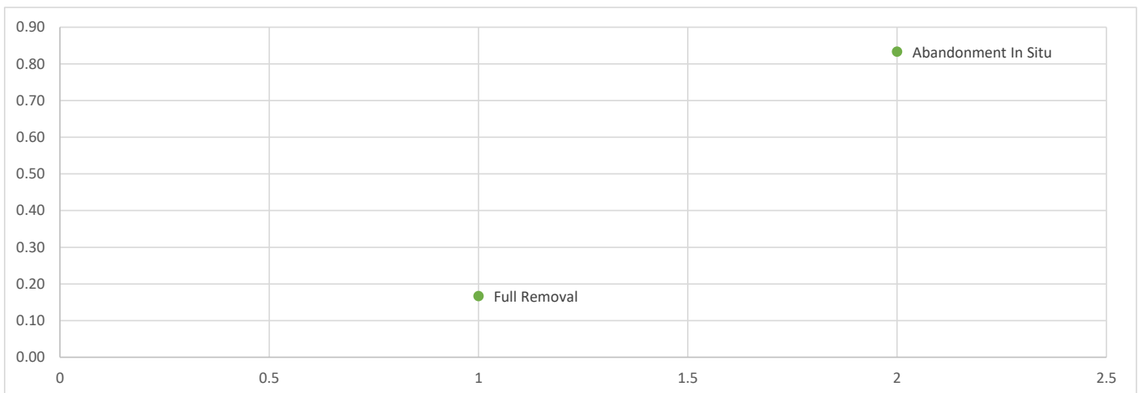
Normalised Array

	Full Removal	Abandonment In Situ	Eigen Vector	Rank
Full Removal	0.17	0.17	0.17	2
Abandonment In Situ	0.83	0.83	0.83	1

Consistency Index

Principal Eigen Value	####
N	2
Consistency Index	####
Random Index (n=2)	0
Consistency Ratio	####

Statement	Ranking	Switch	Rank	Commentary
Abandonment In Situ is of strong importance compared to Full Removal	strong importance	Yes	0.2	



Summary Tab

Reciprocal Array

	Full Removal	Abandonment In Situ
Full Removal	1	0.2
Abandonment In Situ	5	1
Sum	6	1.2

Normalised Array

	Full Removal	Abandonment In Situ	Eigen Vector	Rank
Full Removal	0.17	0.17	0.17	2
Abandonment In Situ	0.83	0.83	0.83	1

Consistency Index

Principal Eigen Value	####
N	2
Consistency Index	####
Random Index (n=2)	0
Consistency Ratio	####

Statement	Ranking	Switch	Rank	Commentary
Abandonment In Situ is of strong importance compared to Full Removal	strong importance	Yes	0.2	

Summary Tab

Reciprocal Array

	Full Removal	Abandonment In Situ
Full Removal	1	3
Abandonment In Situ	0.33	1
Sum	1.33	4

Normalised Array

	Full Removal	Abandonment In Situ	Eigen Vector	Rank
Full Removal	0.75	0.75	0.75	1
Abandonment In Situ	0.25	0.25	0.25	2

Consistency Index

Principal Eigen Value	####
N	2
Consistency Index	####
Random Index (n=2)	0
Consistency Ratio	####

Summary Tab

Statement	Ranking	Switch	Rank	Commentary
Full removal is of moderate importance compared to Abandonment In Situ	moderate importance	No	3