WOOLLYBUTT ENVIRONMENT PLAN - DECOMMISSIONING

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ACRONYMS AND DEFINITIONS USED IN THIS DOCUMENT

Acronym	Definition
ACN	Australian Company Number
AHS	Australian Hydrographic Survey
AIMS	Australian Institute of Marine Science
AIS	automatic identification system
ALARP	as low as reasonably practicable
AMOSC	Australian Marine Oil Spill Centre
AMOSPlan	Australian Marine Oil Spill Plan
AMP	Australian Marine Park
AMSA	Australian Maritime Safety Authority
APASA	Asia-Pacific Applied Science Associates
API	American Petroleum Institute
APPEA	Australian Petroleum Production and Exploration Association
BIA	biologically important area
BOD	biological oxygen demand
BoM	Bureau of Meteorology
CAMBA	China-Australia Migratory Bird Agreement
CEFAS	Centre for Environment, Fisheries and Aquaculture Science
CFC	chlorofluorocarbon
cm	centimetres
CMID	International Marine Contractors Association
CP	cathodic protection
CSIRO	Commonwealth Scientific and Industrial Research Organisation
CSR	Corporate Social Responsibility
DAFF	Department of Agriculture, Fisheries and Forestry
dB	decibels
DEC	Department of Environment and Conservation
DEWHA	Department of Environment, Water, Heritage and the Arts
DISER	Commonwealth Department of Industry, Science, Energy and Resources
DNP	Director of National Parks
DoAWE	Department of Agriculture, Water and the Environment
DoEE	Department of Environment and Energy
DoF	Department of Fisheries
DPaW	Department of Parks and Wildlife
DPIRD	Department of Primary Industries and Regional Development
DSPM	disconnectable single point mooring

Acronym	Definition
EAL	Eni Australia Limited
Eni	Eni S.p.A (Milan Headquarters)
EP	Environment Plan
EPBC	Environment Protection and Biodiversity Conservation
ESD	ecologically sustainable development
et al.	and others
FPSO	floating production, storage and offloading vessel
GESAMP	Group of Experts on the Scientific Aspects of Marine Environmental Protection
GHG	greenhouse gas
GPS	global positioning system
GVI	general visual inspection
HP	high pressure
hr	hour(s)
HSE	health, safety and environment
HSE IMS	Health, Safety and Environment Integrated Management System
HXT	horizontal Xmas tree
Hz	Hertz
IAPP	International Air Pollution Prevention
IMCA	International Marine Contractors Association
IMO	International Maritime Organisation
IMP	Integrity Management Plan
IMS	invasive marine species
IMT	Incident Management Team
IOTC	Indian Ocean Tuna Commission
ISO	International Standards Organisation
IUCN	International Union for Conservation of Nature and Natural Resources
IV	Intervention vessel
JAMBA	Japan-Australia Migratory Bird Agreement
JRCC	Joint Rescue Coordination Centre
JV	Joint Venture
KEF	key ecological feature
Kensington	Kensington West Pty Ltd (in liquidation)
kg	kilograms
km	kilometres
L	litres
LC	lethal concentration

Acronym	Definition
LD	lethal dose
m	metres
MAH	monocyclic aromatic hydrocarbons
MARC	Mobil Australia Resources Company Pty Limited
MARPOL 73/78	International Convention for the Prevention of Pollution from Ships, 1973, as modified by the Protocol of 1978 relating thereto
MDB	mid-depth buoy
mg	milligrams
mL	millilitres
MMbbl	million barrels
MMF	Mackerel Managed Fishery
MMO	marine mammal observer
MoU	Memorandum of Understanding
MPRA	Marine Parks and Reserves Authority
MSDS	Material Safety Data Sheets
MSV	Multipurpose support vessel
NEBA	net environmental benefit analysis
NHP	National Heritage Place
NM	nautical mile
NOPSEMA	National Offshore Petroleum Safety and Environmental Management Authority
NOPTA	National Offshore Petroleum Titles Authority
NORMS	naturally occurring radioactive materials
NOx	oxides of nitrogen
NSW	New South Wales
NWS	North West Shelf
OCIMF	Oil Companies International Marine Forum
OCNS	Offshore Chemical Notification Scheme
OIW	oil in water
OPGGS Act	Offshore Petroleum and Greenhouse Gas Storage Act 2006
OPGGS(E) Regulations	Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2009
OPMF	Onslow Prawn Managed Fishery
OPRC 90	Oil Pollution Preparedness, Response and Co-operation 1990
OSTM	oil spill trajectory model
OVID	Offshore Vessel Inspection Database
Pa	pascal
P&A	plug and abandonment

Acronym	Definition
PAH	polycyclic aromatic hydrocarbon
PDSF	Pilbara Demersal Scale Fishery
PFW	produced formation water
PIC	person in charge
PK	peak
PLF	Pilbara Line Fishery
PMST	Protected Matters Search Tool
PMV	production master valve
PNEC	predicted no effect concentration
POLREP	pollution report
ppb	parts per billion
ppm	parts per million
PSZ	Petroleum Safety Zone
PWC	perf, wash and cement
PWV	production wing valve
RCC	Rescue Coordination Centre
ROKAMBA	Republic of Korea-Australia Migratory Bird Agreement
ROV	remote operated vehicle
SBT1	Scalybutt-1
SBT1H	Scalybutt-1 side-track
SB1M	SB1 manifold
Scf	standard cubic feet
SCSSSVs	surface controlled sub surface safety valves
SEWPaC	Department of Sustainability, Environment, Water, Population and Communities
SITREP	Situation Report
SMFG	Size Management Fish Grounds
SOLAS	International Convention of the Safety of Life at Sea
SPL	sound pressure level
SSSV	sub-surface safety valve
SST	sub-sea test
SUTU	subsea umbilical termination unit
SSWCP	subsea well control package
t	tonnes
Tap Oil	Tap Oil Limited
TSSC	Threatened Species Scientific Committee
UNFCCC	United Nations Framework Convention on Climate Change

Acronym	Definition
UTA	umbilical termination assembly
WA	Western Australia
WAF	water accommodated fraction
WAFIC	Western Australian Fishing Industry Council
WBT1A	Woollybutt-1A
WBT2A	Woollybutt-2A-ST1
WBT4	Woollybutt-4
WBT6	Woollybutt-6
WCE	well control equipment
WHA	World Heritage Area
WOMP	Well Operations Management Plan
WTBF	Western Tuna and Billfish Fishery
°C	degrees Celsius
µ	micron

1 INTRODUCTION

1.1 Overview

Eni Australia Ltd (EAL), as Titleholder under the *Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2009* (Cth) (referred to as the Environment Regulations), has been the operator of the Woollybutt field within Permit Area WA-25-L (Figure 1-1). Production at the Woollybutt field has now ceased and EAL proposes to decommission all remaining infrastructure within Permit Area WA-25-L.

The scope of this Environment Plan (EP) covers the decommissioning activities within Permit Area WA-25-L.

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 Background

EAL produced light crude oil from four wells within the Woollybutt field between 2003 and 2012, specifically:

- Woollybutt 1 including borehole Woollybutt 1H ST1
- Woollybutt 2A including borehole Woollybutt 2A ST3
- Scalybutt 1 including borehole Scalybutt 1H
- Woollybutt 4 including borehole Woollybutt 4H.

During production, the field development consisted of the above-mentioned four subsea wells that produced through subsea wellheads and flexible flowlines to a floating production, storage and offloading (FPSO) facility (Figure 1-2). Production at the field ceased on 16 May 2012 and the FPSO departed from the field on 4 June 2012.

For the period between ceasing production and commencing plug and abandon and decommissioning activities, field management activities have been undertaken in accordance with an EP that was first accepted by NOPSEMA in 2013. The Woollybutt Environment Plan – Field Management and Plug and Abandonment (Field Management EP) has most recently been updated to include plug and abandonment (P&A) activities as well as decommissioning (removal) of some of the Woollybutt field infrastructure. This revised Field Management EP was approved by NOPSEMA on the 1 July 2021.

This EP has been prepared to address decommissioning of all remaining infrastructure at the Woollybutt field.

The Woollybutt Joint Venture comprises:

- Eni Australia Limited (EAL) (65% equity in WA 25-L, permit operator)
- Mobil Australia Resources Company Pty Limited (MARC) (20% equity in WA 25-L)
- Kensington West Pty Ltd (Kensington) (15% equity in WA 25-L) (in liquidation).

Kensington is currently in liquidation and as a result is unable to meet any future joint venture obligations, including the funding of its share of decommissioning activities.

Under the terms of the Joint Venture Agreement, EAL and MARC are now required to assume Kensington's proportionate share of the proposed decommissioning costs (in proportion to their respective EAL/MARC participating interests). The revised adjusted proportionate shares being EAL (76.47%) and MARC (23.53%).

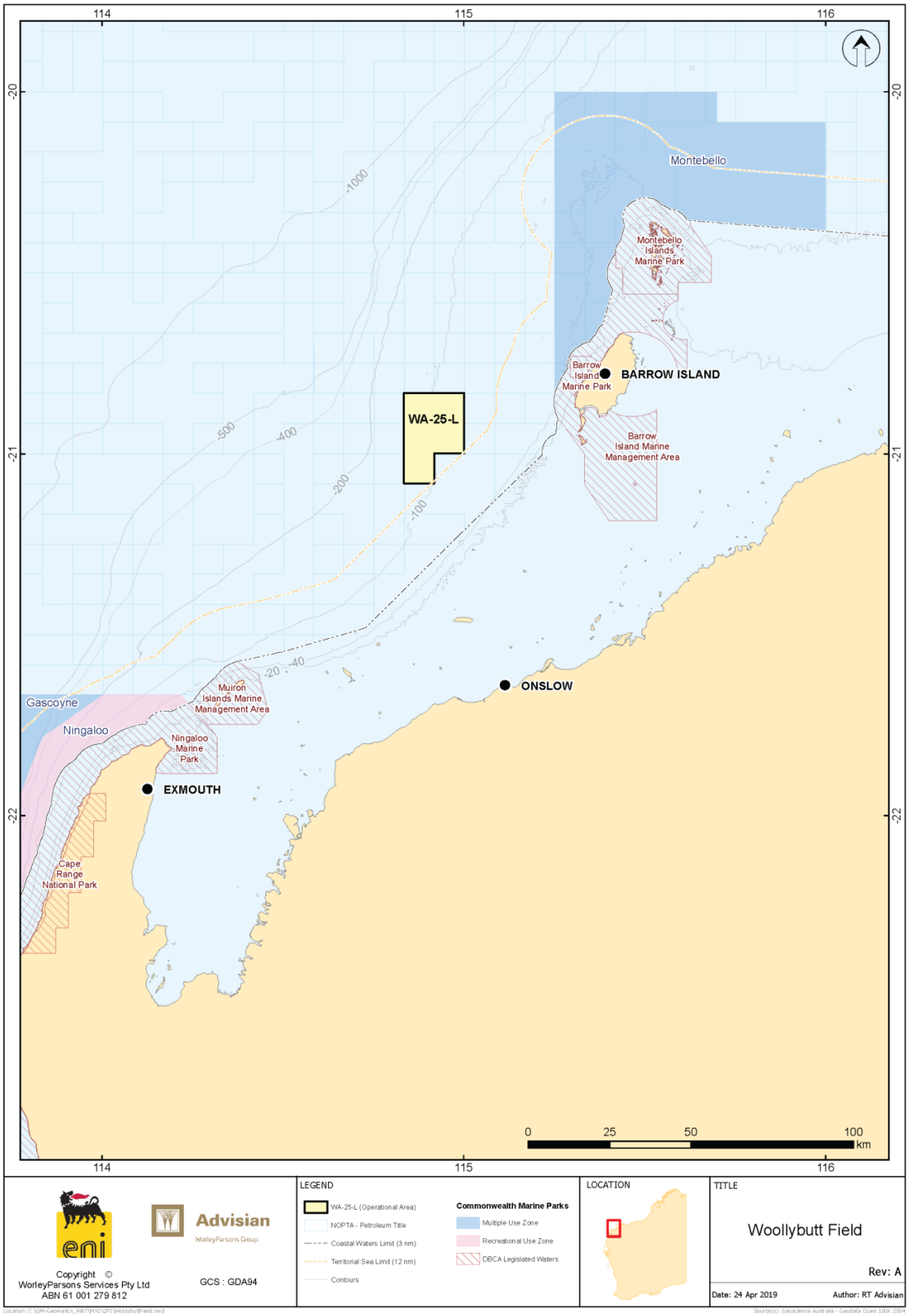

Figure 1-1: Location of the Woollybutt field in WA-25-L and other Petroleum Titles

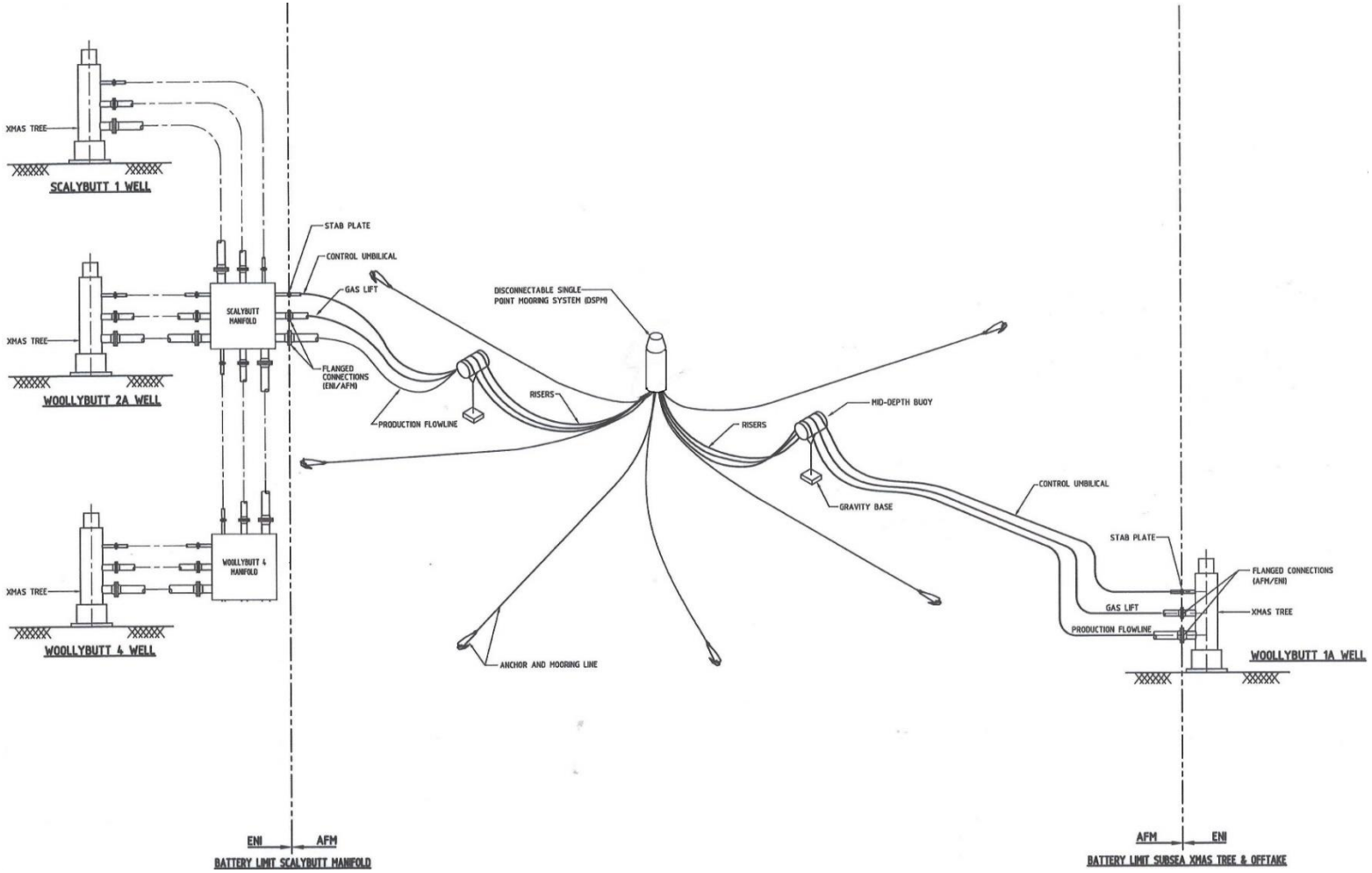

Figure 1-2: FPSO, disconnectable single point mooring and mooring line configuration

1.3 Purpose

The purpose of this EP is to identify the potential environmental risks and impacts that may result from the proposed Petroleum Activities Program (decommissioning of remaining field infrastructure). Management measures have been identified to reduce the environmental risks and impacts to an acceptable level. Activity-specific performance outcomes, standards and measurement criteria have been developed to reduce impacts and risks to 'as low as reasonably practicable' (ALARP).

This EP also provides details of the assessment that has been conducted to identify the preferred decommissioning strategy. This assessment includes demonstration that all feasible decommissioning options were assessed, and the preferred decommissioning strategy provides better or equal environmental outcomes when compared to complete removal of all infrastructure from Permit Area WA-25-L.

The Operational Area for this EP is located within Commonwealth waters, where the Petroleum Activities Program will be undertaken. The extent of the Operational Area is defined in Section 5.3. This EP only addresses the potential environmental impacts from planned petroleum activities within the Operational Area and any potential unplanned events that originate from within the Operational Area.

1.4 Scope

The scope of this EP is the decommissioning of Woollybutt's:

- Mooring anchors and chains
- Umbilical crossing mattresses and grout bags
- Umbilicals and jumpers
- flexible flowlines and jumpers.

The Field Management EP (000105_DV_PR.HSE.1011.000) covers field management activities, P&A activities, recovery of Woollybutt subsea infrastructure, including wellheads, and abandonment of the Corkybark-1 wellhead in situ.

1.5 Environment Plan Summary

An EP summary will be prepared based on the material provided in this EP, addressing the items listed in Table 1-1 as required by Regulation 11(4).

Table 1-1: EP summary

EP Summary material requirement	Relevant section of this EP containing EP Summary material
The location of the activity	Section 5.2
A description of the receiving environment	Section 6
A description of the activity	Section 5
Details of the environmental impacts and risks	Section 9,10
The control measures for the activity	Section 9,10 and 11
The arrangements for ongoing monitoring of the titleholder's environmental performance	Section 12
Response arrangements in the oil pollution emergency plan	Not applicable, there is no credible spill scenario associated with the Petroleum Activities Program.
Consultation already undertaken and plans for ongoing consultation	Section 7
Details of the titleholder's nominated liaison person for the activity	Section 2

1.6 Details of Titleholder

The Woollybutt Joint Venture is the permit holder of Production Licence WA-25-L. EAL operates the field on behalf of the Woollybutt Joint Venture.

EAL's contact details are:

Eni Australia Limited

226 Adelaide Terrace

Perth WA 6000

Telephone: (08) 9320 1111

Eni Australia Ltd ACN is 009475389.

2 DETAILS OF THE LIAISON PERSON

The nominated contact person for this EP is:

Keith Cook

Heath, Safety and Environment (HSE) and Corporate Social Responsibility (CSR) Manager

Eni Australia Ltd

Tel: (08) 9320 1111

Email: eniaus.info@eni.com

2.1 Notifying of Change

Should the titleholder, titleholder's nominated liaison person or contact details for the titleholder or liaison person change, NOPSEMA will be notified in writing of the change and provided with the new details.

3 ENVIRONMENTAL LEGISLATION

This section describes the key Commonwealth legislation, international agreements and industry guidelines that apply to the Petroleum Activities Program.

3.1 Key Commonwealth Legislation

The Petroleum Activities Program will be conducted in Commonwealth waters and are therefore subject to Commonwealth legislation. Key Commonwealth environmental legislation applicable to petroleum operations in Commonwealth waters are detailed in the next subsections. This section does not include Commonwealth legislation relating to oil spill response and preparedness or general vessel operations, as the Petroleum Activities Program does not include a credible spill scenario or any vessel-based activities.

3.1.1 Offshore Petroleum and Greenhouse Gas Storage Act 2006

The *Offshore Petroleum and Greenhouse Gas Storage Act 2006* (OPGGS Act) is the principal legislation managing petroleum activities in Australian Commonwealth waters. The subordinate OPGGS(Environment) Regulations 2009 (OPGGS(E) Regulations) relate specifically to environmental management. The objective of the Regulations is to ensure offshore petroleum operations are performed in a way that is consistent with the principles of ecologically sustainable development (ESD).

The OPGGS Act and supporting regulations address licencing, health, safety and environmental matters for offshore petroleum and gas exploration and production operations in Commonwealth waters. Obligations relating to maintaining and removing equipment and property brought onto title are provided in OPGGS Act Section 572. Section 572 requires the removal of property when it is no longer used, unless NOPSEMA has accepted alternative arrangements where justification is appropriate and with regard to the Australian Government *Offshore Petroleum Decommissioning Guideline.*

Specifically, the OPGGS(E) Regulations prescribe the requirements for managing environmental impacts associated with petroleum activities and require proponents to submit an EP to the Regulatory Authority for approval before commencing activities. As part of these documents, the proponent is required to assess the risks associated with the activities and demonstrate the proposed mitigation measures reduce these risks to ALARP and acceptable levels.

Table 3-1 includes the pertinent sections of the OPGGS(E) Regulations and details the sections of the EP which ensure compliance with the requirements.

Table 3-1: Requirements of the OPGGS(E) Regulations

Reg.	Requirement	Relevant section in the EP
5G	**Demonstration of financial assurance prior condition for acceptance of environment plan**	
5G (1)	This regulation applies if: • An environmental plan for a petroleum activity is submitted under Regulation 9, and • There is a titleholder in relation to the activity immediately before the Regulator decides whether or not to accept the plan under Regulation 10, or • A proposed revision of an environmental plan for a petroleum activity is submitted under Regulation 17, 18 or 19.	Section 13 – Financial Assurance
11A	**Consultation with relevant authorities, persons and organisations, etc.**	
11A (1)	In the course of preparing an environment plan, or a revision of an environment plan, a titleholder must consult each of the following (a relevant person): • Each Department or agency of the Commonwealth to which the activities to be carried out under the environment plan, or the revision of the environment plan, may be relevant • 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 • The Department of the responsible State Minister, or the responsible Northern Territory Minister • A person or organisation whose functions, interests or activities may be affected by the activities to be carried out under the environment plan, or the revision of the environment plan • Any other person or organisation that the titleholder considers relevant.	Section 7– Stakeholder Consultation and Appendix C
11A (2)	For the purpose of the consultation, the titleholder must give each relevant person sufficient information to allow the relevant person to make an informed assessment of the possible consequences of the activity on the functions, interests or activities of the relevant person.	Section 7 – Stakeholder Consultation and Appendix C
11A (3)	The titleholder must allow a relevant person a reasonable period for the consultation.	Section 7 – Stakeholder Consultation and Appendix C

Reg.	Requirement	Relevant section in the EP
13	**Environmental assessment**	
13(1)	*Description of the activity*	
	The environment plan must contain a comprehensive description of the activity including the following: • The location or locations of the activity • General details of the construction and layout of any facility • An outline of the operational details of the activity (for example, seismic surveys, exploration drilling or production) and proposed timetables • Any additional information relevant to consideration of environmental impacts and risks of the activity.	Section 5 – Description of Activity
13(2)	*Description of the environment*	
	The environment plan must: • Describe the existing environment that may be affected by the activity • Include details of the particular relevant values and sensitivities (if any) of that environment.	Section 6 – Description of the Environment
	Requirements	
13(4)	The environment plan must: • Describe the requirements, including legislative requirements, that apply to the activity and are relevant to the environmental management of the activity, and • Demonstrate how those requirements will be met.	Section 3 – Environmental Legislation
13(5)	*Evaluation of environmental impacts and risks*	
	The environment plan must include: • Details of the environmental impacts and risks for the activity • An evaluation of all the impacts and risks, appropriate to the nature and scale of each impact or risk, and • Details of the control measures that will be used to reduce the impacts and risks of the activity to as low as reasonably practicable and an acceptable level.	Sections 9, 10 – Environmental Risk Assessments

Reg.	Requirement	Relevant section in the EP
13(6)	To avoid doubt, the evaluation mentioned in paragraph 13(5)(b) must evaluate all the significant impacts and risks arising directly or indirectly from:	
	• All operations of the activity, and	Sections 9 and 10 – Risks from all operations of the activity
	• Potential emergency conditions, whether resulting from accident or any other reason.	Section 10 – Risks from emergency conditions
13(7)	*Environmental performance outcomes and standards*	
	The environment plan must: • Set environmental performance standards for the control measures identified under paragraph (5)(c) • Set out the environmental performance outcomes against which the performance of the titleholder in protecting the environment is to be measured, and • Include measurement criteria that the titleholder will use to determine whether each environmental performance outcome and environmental performance standard is being met.	Section 11 – Environmental outcomes, standards and measurement criteria
14	**Implementation strategy for the environment plan**	
14(1)	The environment plan must contain an implementation strategy for the activity in accordance with this regulation.	Section 12 – Implementation Strategy
14(2)	The implementation strategy must: • State when the titleholder will report to the Regulator in relation to the titleholder's environmental performance for the activity, and • Provide that the interval between reports will not be more than 1 year.	

Reg.	Requirement	Relevant section in the EP
14(3)	The implementation strategy must contain a description of the environmental management system for the activity, including specific measures to be used to ensure that, for the duration of the activity: • The environmental impacts and risks of the activity continue to be identified and reduced to a level that is as low as reasonably practicable, • Control measures detailed in the environment plan are effective in reducing the environmental impacts and risks of the activity to as low as reasonably practicable and an acceptable level, and • Environmental performance outcomes and standards set out in the environment plan are being met.	Section 12 – Implementation Strategy
14(4)	The implementation strategy must establish a clear chain of command, setting out the roles and responsibilities of personnel in relation to the implementation, management and review of the environment plan, including during emergencies or potential emergencies.	Section 12.2 – Roles and Responsibilities
14(5)	The implementation strategy must include measures to ensure that each employee or contractor working on, or in connection with, the activity is aware of his or her responsibilities in relation to the environment plan, including during emergencies or potential emergencies, and has the appropriate competencies and training.	Section 12.2 – Roles and Responsibilities
14(6)	The implementation strategy must provide for sufficient monitoring, recording, audit, management of non-conformance and review of the titleholder's environmental performance and the implementation strategy to ensure that the environmental performance outcomes and standards in the environment plan are being met.	Section 12.8 – Reporting Section 12 – Inspection and Review Section 12.7 – Non-Conformance
14(7)	The implementation strategy must provide for sufficient monitoring of, and maintaining a quantitative record of, emissions and discharges (whether occurring during normal operations or otherwise), such that the record can be used to assess whether the environmental performance outcomes and standards in the environment plan are being met.	Section 12.5 – Monitoring
14(8)	The implementation strategy must contain an oil pollution emergency plan and provide for the updating of the plan.	Not applicable, there is no credible spill scenario associated with the Petroleum Activities Program.

Reg.	Requirement	Relevant section in the EP
14(8AA)	The oil pollution emergency plan must include adequate arrangements for responding to and monitoring oil pollution, including the following: • The control measures necessary for timely response to an emergency that results or may result in oil pollution • The arrangements and capability that will be in place, for the duration of the activity, to ensure timely implementation of the control measures, including arrangements for ongoing maintenance of response capability • The arrangements and capability that will be in place for monitoring the effectiveness of the control measures and ensuring that the environmental performance standards for the control measures are met, and • The arrangements and capability in place for monitoring oil pollution to inform response activities.	Not applicable, there is no credible spill scenario associated with the Petroleum Activities Program.
14(8A)	The implementation strategy must include arrangements for testing the response arrangements in the oil pollution emergency plan that are appropriate to the response arrangements and to the nature and scale of the risk of oil pollution for the activity.	Not applicable, there is no credible spill scenario associated with the Petroleum Activities Program.
14(8B)	The arrangements for testing the response arrangements must include: • Statement of the objectives of testing • A proposed schedule of tests • Mechanisms to examine the effectiveness of response arrangements against the objectives of testing, and • Mechanisms to address recommendations arising from tests.	Not applicable, there is no credible spill scenario associated with the Petroleum Activities Program.

Reg.	Requirement	Relevant section in the EP
14(8C)	The proposed schedule of tests must provide for the following: • Testing the response arrangements when they are introduced • Testing the response arrangements when they are significantly amended • Testing the response arrangements not later than 12 months after the most recent test • If a new location for the activity is added to the environment plan after the response arrangements have been tested, and before the next test is conducted—testing the response arrangements in relation to the new location as soon as practicable after it is added to the plan, and • If a facility becomes operational after the response arrangements have been tested and before the next test is conducted—testing the response arrangements in relation to the facility when it becomes operational.	Not applicable, there is no credible spill scenario associated with the Petroleum Activities Program.
14(8D)	The implementation strategy must provide for monitoring of impacts to the environment from oil pollution and response activities that: • Is appropriate to the nature and scale of the risk of environmental impacts for the activity, and • Is sufficient to inform any remediation activities.	Not applicable, there is no credible spill scenario associated with the Petroleum Activities Program.
14(8E)	The implementation strategy must include information demonstrating that the response arrangements in the oil pollution emergency plan are consistent with the national system for oil pollution preparedness and response.	Not applicable, there is no credible spill scenario associated with the Petroleum Activities Program.
14(9)	The implementation strategy must provide for appropriate consultation with: • Relevant authorities of the Commonwealth, a State or Territory, and • Other relevant interested persons or organisations.	Section 7 – Stakeholder Consultation

Reg.	Requirement	Relevant section in the EP
15	**Details of titleholder and liaison person**	
15(1)	The environment plan must include the following details for the titleholder: • Name • Business address • Telephone number (if any) • Fax number (if any) • Email address (if any), and • If the titleholder is a body corporate that has an ACN (within the meaning of the *Corporations Act 2001*)—ACN.	Section 1.6 – Details of Titleholder
15(2)	The environment plan must also include the following details for the titleholder's nominated liaison person: • Name • Business address • Telephone number (if any) • Fax number (if any), and • Email address (if any).	Section 2 – Details of Liaison Person
15(3)	The environment plan must include arrangements for notifying the Regulator of a change in the titleholder, a change in the titleholder's nominated liaison person or a change in the contact details for either the titleholder or the liaison person.	Section 12.8 – External Reporting

Reg.	Requirement	Relevant section in the EP
16	**Other information in the environment plan**	

16	The environment plan must contain the following:
	• A statement of the titleholder's corporate environmental policy.
	• A report on all consultations between the titleholder and any relevant person, for regulation 11A, that contains:
	  ○ A summary of each response made by a relevant person
	  ○ An assessment of the merits of any objection or claim about the adverse impact of each activity to which the environment plan relates
	  ○ A statement of the titleholder's response, or proposed response, if any, to each objection or claim, and
	  ○ A copy of the full text of any response by a relevant person.
	• Details of all reportable incidents in relation to the proposed activity.
		Appendix A – HSE Statement
		Appendix C – Stakeholder Consultation Bulletins

3.1.2 Environment Protection and Biodiversity Conservation Act 1999

The *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) is the primary Commonwealth environmental assessment legislation aimed at protecting and managing flora, fauna, ecological communities, environmentally sensitive and heritage places defined as matters of national environmental significance.

On 28 February 2014, NOPSEMA became the sole designated assessor of petroleum and greenhouse gas (GHG) activities in Commonwealth waters in accordance with the Minister for the Environment's endorsement of NOPSEMA's environmental authorisation process under Part 10, section 146 of the EPBC Act. All actions which are petroleum and GHG activities undertaken in Commonwealth waters in accordance with the OPGGS(E) Regulations (noting exceptions for activities with extreme sensitivity, such as those in the Great Barrier Reef or Antarctica) have been approved as "approved classes of actions" and do not require referral, assessment and approval under the EPBC Act 1999. Environmental aspects of the Petroleum Activities Program are therefore regulated by NOPSEMA.

Prior to the abovementioned change in 2014, the Woollybutt Project environmental approval was provided under the EPBC Act (EPBC 2001/365) in 2001. This approval continues to have effect. Table 3-2 presents the conditions of the EPBC approval and details how they have been met within this EP.

The Australian Government Minister for the Environment may make or adopt and implement recovery and management plans for threatened fauna, threatened flora (other than conservation-dependent species) and threatened ecological communities listed under the EPBC Act. Recovery and management plans relevant to this EP are outlined in Section 6.4.

Table 3-2: Conditions from EPBC 2001/365 approval relevant to the Petroleum Activities Program

Condition Number	Condition	Applicable Section of this EP detailing how condition has been met
1	The person taking the action must implement cetacean interaction procedures for supply vessels consistent with Part 8 of the EPBC Regulations 2000.	Not applicable, the Petroleum Activities Program does not include vessel-based activities.
2	The person taking the action must provide the results of pluming studies and analyses of biomarkers on the impacts of discharged produced formation water to the Minister prior to decommissioning.	Outside the scope of this EP
3	Before the Woollybutt Oil Field Production Facility is commissioned, the person taking the action must prepare and submit for the Minister's approval an Oil Spill Contingency Plan detailing the strategy to mitigate potential oil spills. Within two months of production operations commencing, the person taking the action must submit a revised plan for approval, which must incorporate the results of tests on the Woollybutt crude oil for toxicity, weathering and effectiveness of dispersants. The most recently approved plan must be implemented.	Outside the scope of this EP Not applicable, the Petroleum Activities Program does not include vessel-based activities.
4	The person taking the action must not commence decommissioning unless an environment plan that includes measures related to decommissioning is in force under the OPGGS Environment Regulations. The person taking the action must comply with that environment plan.	This EP
5	A plan required by condition 3 is automatically deemed to have been submitted to, and approved by, the Minister if the measures (as specified in the relevant condition) are included in an environment plan (or environment plans) relating to the taking of the action that: a) Was submitted to NOPSEMA after 27 February 2014; and b) Either: i) Is in force under the OPGGS Environment Regulations; or ii) Has ended in accordance with regulation 25A of the OPGGS Environment Regulations.	This EP

Condition Number	Condition	Applicable Section of this EP detailing how condition has been met
5A	Where a plan required by condition 3 has been approved by the Minister and the measures (as specified in the relevant condition) are included in an environment plan (or environment plans) that: a) Was submitted to NOPSEMA after 27 February 2014; and b) Either: i) Is in force under the OPGGS Environment Regulations; or ii) Has ended in accordance with regulation 25A of the OPGGS Environment Regulations, the plan approved by the Minister no longer needs to be implemented.	This EP
5B	Where an environment plan, which includes measures specified in the conditions referred to in conditions 5 and 5A above, is in force under the OPGGS Environment Regulations that relates to the taking of the action, the person taking the action must comply with those measures as specified in that environment plan.	This EP. Environmental Outcomes, Standards and Measurement Criteria are contained in Section 11

3.1.3 Underwater Cultural Heritage Act 2018

The *Underwater Cultural Heritage Act 2018* gives clarity to the present and ongoing jurisdictional arrangements for protecting and managing Australia's underwater cultural heritage in line with the 2010 Australian Underwater Cultural Heritage Intergovernmental Agreement. It is an offence to interfere with any shipwreck covered by the Act.

There are no known shipwrecks located within the Operational Area. Shipwrecks occur outside the Operational Area (SEWPaC, 2012a; 2012b) and are further described in Section 6.3.6.

3.1.4 Environment Protection (Sea Dumping) Act 1981

The *Environment Protection (Sea Dumping) Act* 1981 (the Sea Dumping Act) is the primary piece of legislation regulating loading and dumping waste at sea in Australia. This Act seeks to minimise pollution threats by:

- Prohibiting ocean disposal of waste considered too harmful to be released into the marine environment
- Regulating permitted waste disposal to ensure environmental impacts are minimised.

The Sea Dumping Act also fulfils Australia's international obligations under United Nations Convention on the Law of the Sea, the Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter (London Convention) and associated Protocol.

In instances where infrastructure is proposed to be left on the seabed, the activity may be considered a dumping activity that is regulated under the Sea Dumping Act. In these instances, permits are required from Department of Agriculture, Water and the Environment (DoAWE) prior to these activities.

EAL has met with DoAWE to confirm whether a sea dumping permit is required under the Sea Dumping Act and DoAWE confirmed Sea Dumping Permit(s) are required for the proposed abandonment of the equipment in this EP.

3.1.5 Key Commonwealth Legislation Summary

Table 3-3 summarises the key Commonwealth legislation that is relevant to the environmental aspects of the Petroleum Activities Program.

Table 3-3: Summary of key Commonwealth legislation

Legislation	Requirements
OPGGS Act 2006	Licencing requirements. Section 280 interference with other marine rights. Section 569 operations to be performed in accordance with good oilfield practice. Section 574 written directions can be given to titleholders.

Legislation	Requirements
EPBC Act 1999	Relates to significant impacts on matters of national environmental significance. Conditional EPBC decision in place (EPBC 2001/365).
Underwater Cultural Heritage Act 2018	Relates to the protection of shipwrecks of heritage value. There are no historical shipwrecks within or in the vicinity of the field (see Section 6.3.6).
National Greenhouse and Energy Reporting Act 2007	GHG reporting requirements.
Aboriginal and Torres Strait Islander Heritage Protection Act 1984	Enables the Australian Government to respond to requests to protect traditionally important areas and objects that are under threat, if it appears state or territory laws have not provided effective protection. There are no sites of Aboriginal heritage in the vicinity of the Operational Area (see Section 6.3.6).
Australian Heritage Council Act 2003	Relates to protection of heritage: an Act to establish the Australian Heritage Council, and for related purposes.
Australian Maritime Safety Authority (AMSA) Act 1990	Relates to the protection of the marine environment and maritime and aviation search and rescue services: an Act to establish AMSA.
Native Title Act 1993	Recognising by Australian law that some Indigenous people have rights and interests to their land that come from their traditional laws and customs. There are no Native Title claims in the vicinity of the operational area (see Section 6.3.6).
Environment Protection (Sea Dumping) Act 1981 (the Sea Dumping Act)	The Sea Dumping Act 1981 requires sea dumping permits to be required for particular activities and gives effect to the United Nations Convention on the Law of the Sea and the Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter (London Convention) and associated Protocol.

3.2 State Legislation

The Operational Area for this EP is Permit Area WA-25-L within Commonwealth waters where it is proposed to leave infrastructure in-situ. No activities are planned to occur within State Waters.

3.3 International Agreements

International agreements and conventions that apply to the Petroleum Activities Program are summarised in Table 3-4.

Table 3-4: Applicable international agreements and conventions

International Agreements and Conventions	Summary
Bilateral migratory bird agreements between the Government of Australia and the Government of Japan (JAMBA), China (CAMBA), and Republic of Korea (ROKAMBA)	These agreements recognise international concern for the protection of migratory birds and birds in danger of extinction.

International Agreements and Conventions	Summary
Convention on Biological Diversity 1992	The objectives of the convention are the conservation of biological diversity, the sustainable use of its components and the fair and equitable sharing of the benefits arising out of the utilisation of genetic resources.
Convention on the Conservation of Migratory Species of Wild Animals 1979 (Bonn Convention)	This convention aims to improve the status of all threatened migratory species by national action and international agreements between range states.
Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter 1972 (known as the London Protocol)	The London Convention contributes to the international control and prevention of marine pollution by prohibiting the dumping of certain hazardous materials.
United Nations Convention on the Law of the Sea 1982	This convention recognises the desirability of establishing a legal order for the seas and oceans which will facilitate international communication, and will promote the: • Peaceful uses of the seas and oceans • Equitable and efficient utilisation of their resources • Conservation of their living resources • Study, protection and preservation of the marine environment.
United Nations Framework Convention on Climate Change (UNFCCC) 1992	The UNFCCC is an international environmental treaty with the objective of stabilising GHG concentrations at a level that would prevent dangerous anthropogenic interference with the climate system.

3.4 Industry Guidelines

The Australian petroleum exploration and production industry operates under various codes of practice, such as the Australian Petroleum Production and Exploration Association (APPEA) Code of Environmental Practice (2008). These provide guidelines for activities that are not subject to prescriptive regulation and have evolved from the collective knowledge and experience of the oil and gas industry, nationally and internationally.

EAL is a member of APPEA and, when undertaking its projects and activities, adheres to the provisions of its Code of Environmental Practice. The APPEA Code of Environmental Practice was a key reference in preparing for the environmental risk assessment and development of performance outcomes in this EP. A summary of applicable industry guidelines is provided in Table 3-5.

Table 3-5: Applicable industry guidelines

Guidelines and Agreements/ Conventions	Summary
APPEA Code of Environmental Practice	October 2008 – Management system and a comprehensive list of environmental guidelines for the petroleum industry. Provides guidelines for activities that are not formally regulated and have evolved from the collective knowledge and experience of the oil and gas industry.
Environmental Plan Content Requirements (N04750-GN1344)	Revision 3, April 2016, NOPSEMA – This guidance note aims to provide guidelines for use by titleholders in preparing EPs for submission to NOPSEMA.
Offshore Petroleum Decommissioning Guideline – Department of Industry, Innovation and Science	January 2018 – Decommissioning guideline confirming the Australian Government's policy expectation that removal of property is the "base case" or default decommissioning requirement. Assists offshore petroleum titleholders to plan and seek the regulatory approvals necessary to undertake a decommissioning project, and to understand the expectations of relevant decision-makers.

4 DECOMMISSIONING OPTIONS ASSESSMENT

4.1 Overview

A decommissioning options assessment was undertaken to determine if there were any feasible options to the base case of full removal outlined in Section 572 (3) and, if there were any feasible alternatives, whether they provided better or equal environmental outcomes to the case of complete removal.

The decommissioning options assessment comprised:

- A review of degradation and habitat studies commissioned by EAL to understand the degradation rates of the Woollybutt subsea infrastructure and whether the Woollybutt subsea infrastructure is providing habitat of value to the marine environment. The decommissioning options assessment also included a review of other scientific studies undertaken on pipelines across the North-West Shelf (NWS) to further understand the environmental outcomes of the decommissioning options being considered (Section 4.3).
- A high-level comparative assessment of the decommissioning options to determine the preferred decommissioning option from a technical, safety, environmental, economic and social perspective. The comparative assessment methodology is described in Section 4.5 and is based on best practice, as described in the Oil and Gas United Kingdom Guidelines for Comparative Assessment in Decommissioning Programmes (Oil and Gas UK, 2015). The comparative assessment comprises an initial options screening assessment to determine what decommissioning options would be carried forward for the comparative assessment. It also contained an assessment of the selected options against legislation to ensure options align with legislative requirements.
- An equal or better outcomes assessment to determine whether any alternate option presents equal or better environmental outcomes when compared to the base case of full removal (DIIS, 2018) (Section 4.6). This equal or better outcomes assessment involved a detailed assessment of all the potential environmental risk and benefits of the options and an assessment of the options in accordance with the principles of ESD.

4.2 Scope of Assessment

The scope of the options assessment is limited to the infrastructure that is remaining at the Woollybutt field at the completion of P&A and infrastructure removal activities, which are being undertaken under a separate EP. This remaining infrastructure is listed in Table 4-1. Further details on the composition and size of the infrastructure components are provided in Section 5.

Table 4-1: Infrastructure within the scope of the options assessment

Infrastructure	Description
Disconnectable single point mooring (DSPM) anchors and chains	Six anchors weighing approximately 35 Te each, and 6 anchor chains
Umbilical crossing mattresses and grout bags	Eight umbilical crossing mattresses and 16 grout bags
Umbilicals and umbilical jumpers	Ten umbilicals and umbilical jumpers up to approximately 5.8 km in length
Flexible and reinjection flowlines and jumpers	Four flowlines 2-1/2 inch to 6 inch and 1700 to 5750 m in length. Four jumpers 2-1/2 inch to 6 inch and 17 to 50 m and four risers 6 inch and 2-1/2 inch 1035 to 1045 m in length

4.3 Supporting Studies

To understand the potential environmental risks and benefits associated with the decommissioning options, scientific studies of flowlines and pipelines in the marine environment of the NWS were reviewed (Table 4-2). These studies observed a diverse range of pelagic and reef-dependant species associated with pipelines and flowlines, including commercially fished species (McLean, et al., 2017, Bond et al.; 2018, Bond et al., 2020; Bond et al., 2021).

Table 4-2: Summary of scientific studies

Date	Study	Report/Publication	Key Findings
2017	Study of fish associations along a 2 to 3 km subsection of the Echo Yodel pipeline.	McLean et al., 2017. Using industry remote operated vehicle (ROV) videos to assess fish associations with subsea pipelines. *Continental Shelf Research* **141**: 76–97.	Total of 5962 individual fish from 92 species and 42 families, characterised by high abundance of commercially important fishes (incl. snappers and groupers). Presence of fish habitat on the pipeline in the form of high complexity sponges and deep-water corals. These habitats likely offer significant food source and refuge for fish, but also for invertebrates upon which fish feed. Presence of larval fish, juveniles, sub-adults and adults suggests pipelines may be enhancing, rather than simply attracting, fish stocks.

Date	Study	Report/Publication	Key Findings
2018	Study of fish assemblages associated with the Griffin pipelines (42.3 km) using a baited remote underwater vehicle system.	Bond et al., 2018d. The influence of depth and a subsea pipeline on fish assemblages and commercially fished species. *PLoS ONE* **13** (11): e0207703.	Total of 14,953 fish from 240 species (225 on-pipeline; 131 off-pipeline) and 59 families (56 on-pipeline; 39 off-pipeline). The pipeline was characterised by higher biomass and abundances of larger-bodied, commercially important species (goldband snapper; saddletail snapper; Moses' snapper) and possessed catch value two to three times higher per stereo-baited remote underwater vehicle deployment than that of fish observed off-pipeline. Adjacent natural seabed habitats possessed higher abundances of species of no or low commercial value (yellowtail scad; threadfin bream; crescent grunter) compared to on-pipeline.
2020	Study of fish assemblages and habitats along sections of the Pluto trunkline within the Montebello AMP.	McLean et al., 2020a. Fish-habitat associations on a subsea pipeline within an Australian Marine Park. Marine Environmental Research 153: 104813.	Total of 7493 fish from 81 species and 33 families. Of these 81 species, 27 are considered commercially important species. The pipeline possessed quite uniform coverage of encrusting marine growth (coralline algae, bryozoans, ascidians, etc.) with patchy occurrences of more structurally complex sponges and black/octocoral forms. Fish species richness and abundance of commercially targeted Moses' snapper were correlated positively with increasing cover of sponges.

Date	Study	Report/Publication	Key Findings
2020	Analysis of interactions between commercial fishers and oil and gas infrastructure in the UK between 1989 and 2016 to understand the risks and consequences of interactions between commercial fishing and oil and gas infrastructure	Rouse, S., Hayes, P., and Wilding, T. A. 2020. Commercial fisheries losses arising from interactions with offshore pipelines and other oil and gas infrastructure and activities. – ICES Journal of Marine Science, 77: 1148–1156.	Between the years 1989 and 2016, there were 1590 recorded incidents of interactions between commercial fishers and oil and gas infrastructure in the UK. The consequences of these incidents included financial loss, vessel abandonment or an injury or fatality. When categorised by the type of oil and gas infrastructure involved in the interaction, the highest percentage of interactions were with debris from the oil and gas industry, which is defined as including scaffolding poles, safety equipment and metal frameworks. The second highest category of recorded interactions was with 'unknown' hazards. However, in 63.9% of cases where the hazard was unknown, the nearest known hazard was pipelines. Therefore, it is assumed the cause of the interaction were the pipelines. Production infrastructure, which includes wellheads, accounted for 4% of the interactions. The study also found that over time, the number of recorded interactions has declined, despite the oil and gas industry activities increasing over the same period of time. This reduction in interaction numbers is thought to be a result of: • Improvements in communication between commercial fishers and the oil and gas industry • Improved mapping of the location of oil and gas infrastructure locations • Advances in vessel global positioning system (GPS) technologies.

Date	Study	Report/Publication	Key Findings
2021	Assessment of fish abundance and total species richness along each of the four flowlines.	McLean D, Bond T, Bierwagen S, Birt M. 2021. Fish and Benthic Communities associated with flowlines in the Woollybut Field. Published by the Australian Institute of Marine Science for EAL.	This study examined benthic, mobile invertebrate and fish communities associated with four flowlines within the Woollybutt field. The area is flat and featureless and comprised of carbonate sands, no published information currently exists on marine ecosystems in the vicinity. Currently 7% of the flowlines are fully buried, 32% partially buried and the remainder unburied. A degradation study by Atteris predicts that over the next 10-30 years most sections of the flowlines will self-bury up to 60-90%. Burial to a degree will limit the availability of hard substrate for benthos to attach to and grow, however benthos can still grow on hard surfaces where they exist just beneath the surface. Burial is unlikely to result in the complete loss of colonising benthos although it may change the nature and abundance of colonising benthos. Epibenthic communities along the flowlines were structurally complex, present in densities of up to 75% cover with 71%of quadrants having biota >40 cm in height. Along the flowlines 10216 fish from 40 species and 22 families were observed. This included 1794 fishery target fish representing 19 species at a density of 195 fishery target fish per 1 km of flowline. The most common species observed during the study include cardinal fish (Apoginidae spp), *Epinephelus areolatus* (areolate grouper) and various snapper species (*Lutjanus quinquelineatue, Lutjanus malabaricus, Lutjanus vitta)* Species richness observed (37 spp) is very similar to that observed by McLean et al. (2017) and Bond et al. (2018a) on the Echo Yodel pipeline.
2021	Degradation study undertaken by Atteris on behalf of EAL on the degradation of the flowlines, umbilicals, mattresses and grout bags, anchors and associated infrastructure.	Atteris 2020. Woollybutt decommissioning. Inspection criticality review. 20-019-103-RP-002 007104.00.P.Z. RV.A0004_REV01.	The infrastructure is expected to self-bury between 60 to 90% within 30 years of decommissioning. Metals within the infrastructure will take up to 1200 years to completely degrade and plastics within the infrastructure will take between 1000 to 10,000 years to completely degrade.

4.4 Relevant Legislative Requirements

An assessment has been completed to understand how the decommissioning options align with the relevant legislation.

The legislation that was determined to be relevant to this options assessment includes:

- Offshore Petroleum and Greenhouse Gas Storage Act 2006
- Environment Protection (Sea Dumping) Act 1981.

International conventions/guidelines determined to be relevant:

- IMO 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 Guidelines and Standards, 1989, IMO

Table 4-3: Current legislation relevant to the comparative assessment for decommissioning the Woollybutt field

Commonwealth legislation	Details
OPGGS Act 2006	Section 572 requires titleholders to: • Maintain all structures, equipment and property in a title area in good condition and repair so that they can be removed, and • Remove these when no longer being used in connection with operations authorised by the title. Section 572 (7) of the OPGGS Act provides an exception to duty where titleholders may implement alternatives to complete removal, provided appropriate justification is outlined in an accepted EP. Section 270 of the OPGGS Act states the titleholder can only surrender the title if it has removed all property to the satisfaction of NOPSEMA or made arrangements that are satisfactory to NOPSEMA in relation to that property. To give context to Section 572 and Section 270, the Offshore Petroleum Decommissioning Guideline (DISER, 2018) states the complete removal of infrastructure and the plugging and abandonment of wells is the default decommissioning requirement under the OPGGS Act. Furthermore, the Offshore Petroleum Decommissioning Guideline (DISER, 2018) states that "the titleholder must demonstrate that the alternative decommissioning approach delivers equal or better environmental, safety and well integrity outcomes compared to complete removal".
Environment Protection (Sea Dumping) Act 1981	The Sea Dumping Act requires sea dumping permits for particular activities and gives effect to the United Nations Convention on the Law of the Sea and the Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter (London Convention) and associated Protocol. In instances where infrastructure is proposed to be left on the seabed, the activity may be considered a dumping activity that is regulated under the Sea Dumping Act (Section 3.1.4).

International Guidelines	Details
IMO Resolution A.672 (16)	The IMO Resolution A.672 (16) is the approval of the "Guidelines and Standards for the removal of offshore installations and structures on the continental shelf and the exclusive economic zone". The approval is granted by the IMO and is made pursuant to the United Nations Convention on the Law of the Sea, 1982. The guidelines provide for disused installations or structures to be left on any continental shelf or in any exclusive economic zone where non-removal or partial removal is consistent with the guidelines or standards. Particularly, the installations or structures must be located in waters deeper than 75 m and have been installed prior to 1 January 1998. In particular it states *"The decision to allow an offshore installation, structure, or parts thereof, to remain on the seabed should be based, in particular, on a case-by-case evaluation, by the coastal State with jurisdiction over the installation or structure, of the following matters:* 1. *Any potential effect on the safety of surface or subsurface navigation, or of other uses of the sea.* 2. *The rate of deterioration of the material and its present and possible future effect on the marine environment.* 3. *The potential effect on the marine environment, including living resources.* 4. *The risk that the material will shift from its position at some future time.* 5. *The costs, technical feasibility, and risks of injury to personnel associated with removal of the installation or structure; and* 6. *The determination of a new use or other reasonable justification for allowing the installation or structure or parts thereof to remain on the sea-bed."*

4.5 Comparative Assessment

4.5.1 Options Screening

An options screening assessment was undertaken to determine which alternative options would be carried forward for the comparative assessment. Options that were not technically feasible or that provided little environmental benefit were excluded from the comparative assessment. Similar subsea assets were divided into groups for this options screening and various decommissioning options were assessed for each asset group. The screening criteria used for each option were technical limits, required equipment, industry experience and complexity of risks. Table 4-4 summarises the five options considered in the initial screening assessment and summarises the outcomes of the options screening. The options selected from the options screening are summarised in Section 4.5.2.

Table 4-4: Options selected for decommissioning options assessment

Option screened	Applicable subsea assets	Comments	Included in options assessment
Base case – complete removal	DSPM anchors and chains	Complete removal of infrastructure is the base case under the OPGGS Act. This	✓

Option screened	Applicable subsea assets	Comments	Included in options assessment
	Umbilical crossing mattresses and grout bags Umbilicals and umbilical jumpers Flexible and reinjection flowlines and jumpers	option must be included in the options assessment. An overview of the complete removal methodology for the infrastructure components is provided in Section 4.5.2.	
Leave in situ	DSPM anchors and chains Umbilical crossing mattresses and grout bags Umbilicals and umbilical jumpers Flexible and reinjection flowlines and jumpers	Leave in situ involves leaving the infrastructure in place or intact. Leave in situ is considered an option for all remaining infrastructure as it has the potential to provide equal or better options than the base case of complete removal. An overview of this option is provided in Section 4.5.2.	✓
Rock dumping – accurately placing rock aggregate over infrastructure	Umbilicals and umbilical jumpers Flexible and reinjection flowlines and jumpers	Rock dumping involves using a specialised vessel to dump rock aggregate over the remaining infrastructure. This would potentially reduce the risk of snagging from trawling vessels. Rock dumping has been undertaken previously in the North Sea and Canada on flowlines; accurate placement of rock may be difficult. Risks associated with vessel operations would also be applicable to this option. There is also the potential for sediment disturbance as a result of rock dumping. Rock dumping has been considered unsuitable for DSPM anchors and chains, umbilical crossing mattresses and grout bags. The DSPM anchors do not pose a snag hazard as they embedded in the seabed, the chains are slack, located on the seabed and are likely to bury overtime. Therefore, it has been determined that rock dumping would provide little environmental benefit. Due to their small size the accurate placement of rocks on umbilical crossing mattresses and grout bags would be difficult. This option is further evaluated in the decommissioning options assessment. An overview of what this option involves is provided in Section 4.5.2.	✓
	DSPM anchors and chains Umbilical crossing mattresses and grout bags		×
Trench and bury – covering infrastructure to	Umbilicals and umbilical jumpers	Trench and bury involves leaving the infrastructure in place and intact but covered to minimise risks of snagging. It	×

Option screened	Applicable subsea assets	Comments	Included in options assessment
minimise the risk of snagging	Flexible and reinjection flowlines and jumpers DSPM anchors and chains Umbilical crossing mattresses and grout bags	would involve using a dive support vessel with ROV to monitor the operation, and a vessel with chosen trenching technology, i.e. jetters, ploughs or trenchers. The trench is dug either alongside or beneath the flowline or umbilical and the flowline/umbilical is then rolled into it. The trench is then either backfilled or left to backfill naturally. Trench and burying would cause sediment disturbance as a result of trenching. Risks associated with vessel operations are also applicable to this option. Trenching may not be suitable for Woollybutt soils as they comprise very soft, easily disturbed silty sediment. Hence, seabed disturbance may be significant. The infrastructure such as located on the seabed is also likely to self-bury over time (Atteris, 2021). It has therefore been determined that trench and bury provides little environmental benefit and is not evaluated further.	
Partial removal	Removal of umbilicals	This option involves leaving the DSPM anchors and chains in situ and removing infrastructure that has the potential to cause impacts associated with degradation of subsea materials over time, such as flowlines and flowline jumpers, umbilicals and umbilical jumpers and associated umbilical crossing mattresses and grout bags. Partial removal is considered an option, as it decreases effort required compared to complete removal of infrastructure, while addressing the risks associated with degrading materials which may cause an impact to the marine environment over time. Partial removal is a widely accepted method in the United States of America and the Asia Pacific region. This option is further evaluated in the decommissioning options assessment. An overview of what this option involves is provided in Section 4.5.2.	✓

4.5.2 Decommissioning Options

In addition to the base case, a number of decommissioning strategies are available for the infrastructure remaining in the Woollybutt field. Each of these options may require different activities in the field. Therefore, a high-level activity description for each decommissioning option is provided in the next sections.

4.5.3 Full Removal of all Infrastructure (the Base Case)

The following activities would be required to be undertaken if full removal of all infrastructure was to occur.

4.5.3.1 Vessel Use

Infrastructure removal from the field would require the use of one or more vessels. It is likely specific vessels would be required for the removal of the flowlines and umbilicals. Vessels will be selected with the ability to recover the specifications (such as weight and size) of the remaining infrastructure. Although the exact vessel requirements would be subject to change, a support vessel and/or multipurpose support vessel (MSV) is representative of the vessels likely to be required. Table 4-5 and Table 4-6 detail the specifications of a typical support vessel and MSV.

Table 4-5: Typical support vessel details

Parameter	Description
Draft (max)	63.25 m (max)
Length	56.8 m
Gross tonnage	1475 Gt
Hull	Steel
Fuel type	Marine diesel
Total fuel volume	138.2 m³
Volume of largest fuel tank	30.4 m³

Table 4-6: Typical multipurpose support vessel (MSV)

Parameter	Description
Draft (max)	6-8 m
Length	85 to 130 m
Berths	100 persons
Gross tonnage	4000-13000 Gt
Fuel type	Marine diesel
Total fuel volume	2000-2500 m³
Volume of largest fuel tank	250 m³

4.5.3.2 Removal of DSPM Anchors and Chains

Removal of anchors may require dredging and excavation using ROV(s) to dislodge the anchors, which are embedded in a cemented sand/weak calcarenite layer at 5 to 6 m below the mudline. The chains will be hooked up using ROV(s) to a vessel crane which will pull the chains and anchor at the same time to dislodge them from the seabed. If this attempt does not remove anchors, excavation will be required prior to another dislodgement attempt. Once anchors and chains are dislodged from the seabed they will be recovered to the vessel via the crane.

4.5.3.3 Removal of Umbilical Crossing Mattresses and Grout Bags

The recovery method for umbilical crossing mattresses and grout bags will be engineered using the existing lifting points where possible. Typically, crossing mattress lifting points are those that were initially used during their installation.

Recovery of crossing mattresses and grout bags from the marine environment will require the deployment of ROV(s) to lock the rigging to suitable lift points as determined by engineering analysis. If lift points are unusable or unavailable, recovery baskets or grab tools may be required. Grout bags have minimal lifting points. Once suitable safe lifting arrangements are in place, the infrastructure can be recovered to the vessel via the crane.

4.5.3.4 Removal of Umbilicals and Umbilical Jumpers

Recovery of umbilicals and umbilical jumpers will require the deployment of ROV(s) from the vessel to the marine environment. It is likely the ROV(s) will perform sediment relocation and water jetting activities to excavate seabed materials to gain access to the umbilicals and jumpers. ROV(s) may also need to do some minor cutting and/or cleaning of umbilicals and jumpers to allow them to be safely connected to vessel cranes. Once safe lifting arrangements are in place, the infrastructure can be recovered to the vessel via the crane. For flexible umbilicals and flowlines, if one end only may be lifted via crane, the remainder of the infrastructure can then be reeled to the vessel deck, using a reverse installation technique.

Umbilicals and umbilical jumpers are cut and disconnected from each other prior to removal. Cutting will be performed during equipment removal activity, which is covered in the Field Management EP.

4.5.3.5 Removal of Flowlines and Jumpers

Removal of flowlines and jumpers will involve similar methods to that required for removal of umbilicals and umbilical jumpers.

4.5.3.6 Helicopter Use

In the instance where vessels have helidecks and are in the operational area for long enough, crew transfers may be required via helicopter. Helicopter operations will be limited to taking off and landing on the vessel's helideck but may result in noise emissions to the marine environment.

Helicopter refuelling may also be required on the vessel's helideck.

4.5.4 Leave all Infrastructure in Situ

All infrastructure will be left in-situ with no vessel or other activities required.

4.5.5 Rock Dumping

The option to leave infrastructure in situ with rock dumping to protect umbilicals, umbilical jumpers, flexible and reinjection flowlines and jumpers will require the use of vessels and helicopters as described in Section 4.5.3.

Vessels will carry rock material to the operational area and place it on the seabed to bury the infrastructure. This will result in rock material also being placed on the seabed immediately adjacent to the umbilicals. ROVs will be used to ensure rock is dumped in the correct location and to conduct post-activity surveys of the area.

4.5.6 Partial Removal of Infrastructure

Partial removal presents an option of removing some subsea infrastructure, while leaving other subsea infrastructure in situ (refer Table 4-4). The same methods described for full removal (Section 4.5.3) would apply for removing the applicable infrastructure.

4.5.7 Comparative Assessment Criteria

The decommissioning options selected were assessed against five main criteria and 11 sub-criteria, as outlined Table 4-7.

Table 4-7: Criteria and sub-criteria used in the Woollybutt comparative assessment

Criteria	Sub-Criteria	Hazards Risk-Ranked
Technical	Technical feasibility	The ability to technically achieve the option.
	Industry experience	History of the option and likelihood of failure based on internal and external experience.
Health and Safety	Risk to project personnel offshore	The risk to people offshore during the implementation of the option. Risks may include lifts, cutting, rigging, diving, clean-up and handling of assets and presence of naturally occurring radioactive materials (NORMS).
	Risk to other marine users	The risk to other marine users during the implementation of the option. The combined safety risk to the crews of commercial fishing vessels, the crews of defence vessels and the crew and passengers of commercial shipping vessels.
Environment	Water quality and sediment impacts	Environmental impacts during and after implementation of the option. This may include impacts to water quality through turbidity or contamination, impacts to seabed sediments from lifts or drops, and impacts to the marine environment from an unplanned spill.
	Ecological services	Potential environmental benefit during or after implementation of the option. This may include environmental benefit from the provision of marine habitat.

Criteria	Sub-Criteria	Hazards Risk-Ranked
	Emissions	Environmental impacts during and after implementation of the option resulting from the combustion of fuels and other processes to generate power onboard vessels, for transportation purposes and the fabrication of structures or other equipment.
	Waste	Environmental impacts during and after implementation of the option resulting from routine discharges to the environment, the disposal of required materials and fabrication by-products.
Economic	Project cost	Comparative cost of implementing the option: **Low cost** $1 million **Medium cost** $1-2 million **Medium high cost** $2-3 million **High cost** $>3 million
Socio-Economic	Commercial impact on other marine users (commercial, fishers, shipping and defence) during activities	Commercial impacts on other marine users (commercial fishers, shipping and defence) due to displacement from the project site during activities.
	Residual impact on other marine users following implementation of the options	Extent of impacts to other marine users following implementation of the option.

4.5.8 Method of Assessment

While all assessment criteria are important, certain criteria may be more relevant to specific decommissioning programs and sites. Therefore, the assessment criteria were weighted to determine their relative importance in the context of the Woollybutt field (refer to Section 4.5.9).

Once weightings were assigned to the criteria, the impacts associated with each criterion were ranked in accordance with EAL's risk matrix outlined in Section 8.4, with risks converted to a numerical form (comparative number).

The various decommissioning options for the infrastructure were assessed using the following method:

- A risk rating was given to each hazard using EAL's risk matrix (Section 8.4) (except project cost)
- Project cost risk rankings were assigned for each option as follows: <$1 million = 1, $1-2 million = 2, $2-3 million = 3, >$3 million = 4
- Sub-criterion ratings were the maximum of their respective risk ratings
- Mean scores were calculated for each criterion, then multiplied by the pre-decided weighting value
- A sensitivity analysis was also undertaken where scores were calculated without the weighting value, to eliminate any bias as a result of weighting

- Risk ratings were summed for each criterion to determine the overall ranking for each option
- The option with the lowest score (lowest risk) (summed comparative number) was considered most preferred.

4.5.9 Weighting of Assessment Criteria

While all assessment criteria are important, certain criteria may be more relevant to specific decommissioning programs and sites. Therefore, the assessment criteria were weighted to determine their relative importance in the context of as shown in Table 4-8. A sensitivity analysis was also undertaken where scores were calculated without the weighting value, to eliminate any bias as a result of weighting.

Table 4-8: Weighting of assessment criteria used in the Woollybutt comparative assessment

Criterion	Criterion Weighting	Weighting Justification
Technical	10%	Options considered less technically feasible or that provided little environmental benefit were screened out during the Options Screening Assessment.
Health and Safety	20%	Offshore and onshore operations are conducted routinely, and processes, procedures and controls have been established to ensure the risks involved are reduced to ALARP.
Environment	30%	Water quality and sediment impacts from seabed disturbance are likely to be minimal, as the seabed surrounding the Woollybutt field is of relatively low biodiversity with no species or communities present that are of ecological significance. Metal contamination may accumulate in sediments and become bioavailable. The hard substrate provided by assets may currently enhance marine growth and fish aggregation. Waste generation, NORMS, disposal and emissions are further considerations.
Economic	10%	Decommissioning options involving field activities are unlikely to vary significantly in cost.
Socio-Economic	30%	Socio-economic impacts on other marine users (commercial fishers, shipping and defence) are unlikely to be significant due to the location of the project site. Residual impacts to commercial fishers after decommissioning will vary depending on the type of fishing activities conducted. Hard substrate enhancing fish aggregation may be beneficial to trap fishers. Assets decommissioned in situ may pose a snagging risk to trawl fishers.

The outcomes of the technical feasibility and economic comparative assessment, health and safety comparative assessment and the environment and socio-economic comparative assessment are outlined in the next sections. The environmental and socio-economic assessment is a summary of the environmental and socio-economic assessment undertaken as part of the comparative assessment. A more detailed assessment of the environmental and social impacts and risks of the decommissioning options is outlined in Section 4.6.1 as part of the equal or better outcomes assessment.

4.5.10 Technical Feasibility and Economic Assessment

Infrastructure/ Options	Sub-criteria	Base case (Complete removal)	Leave in-situ	Rock dumping	Partial Removal
DSPM anchors and chains	**Technical feasibility/ industry experience**	Feasible – moderate complexity. Anchors are embedded in a cemented sand/ weak calcarenite layer at 5 to 6 m below the mudline. Dredging and excavation may be required to aid anchor retrieval. The chains are lying on the seabed and would be recovered to vessel via crane (Section 4.5.3) The proposed method has been implemented by industry in the past.	Feasible – no activity required.	N/A – screened out, refer to Table 4-4.	N/A no activity required.
	Cost	Medium-high – $2 to 3 million.	Nil	N/A	N/A
Umbilical crossing mattresses and grout bags	**Technical feasibility/ industry experience**	Feasible – low complexity. Engineering of the concept solution has manageable complexities, and the proposed method has been successfully implemented in the past. Refer to Section 4.5.3 for description of removal activity.	Feasible – no activity required.	N/A – screened out, refer to Table 4-4.	Feasible – low complexity. Engineering of the concept solution has manageable complexities, and the proposed method has been successfully implemented in the past. Refer to Section 4.5.3 for description of removal activity.
	Cost	Medium – $1 to 2 million.	Nil	N/A	Medium – $1 to 2 million.

Infrastructure/ Options	Sub-criteria	Base case (Complete removal)	Leave in-situ	Rock dumping	Partial Removal
Umbilicals and umbilical jumpers	**Technical feasibility/ Industry experience**	Feasible – moderate complexity ROV will be used for cutting the umbilicals into sections and umbilicals will likely be reverse-reeled onto the vessel. Engineering of the concept solution has manageable complexities, and the proposed method has been successfully implemented in the past. Refer to Section 4.5.3 for description of removal activity.	Feasible – no activity required. .	Rock dumping umbilicals and umbilical jumpers has manageable complexities and has been implemented in the past. Refer to Section 4.5.5 for description of activity.	Feasible – low complexity. Engineering of the concept solution has manageable complexities and the proposed method has been successfully implemented in the past. Refer to Section 4.5.3 for description of removal activity.
	Cost	Very high – >3 million.	Nil	Medium – $1 to 2 million.	Very high – > 3 million.
Flexible and reinjection flowlines and jumpers	**Technical feasibility/ industry experience**	Feasible – moderate complexity. ROV will be used for cutting the flowlines into sections and flowlines will likely be reverse-reeled onto the vessel Engineering of the concept solution has manageable complexities and the proposed method has been successfully implemented in the past. Refer to Section 4.5.3 for description of removal activity.	Feasible – no activity required.	Rock dumping flowlines and jumpers have manageable complexities and have been implemented in the past. Refer to Section 4.5.5 for description of activity.	Feasible – moderate complexity. ROV will be used for cutting the flowlines into sections and flowlines will likely be reverse-reeled onto the vessel Engineering of the concept solution has manageable complexities and the proposed method has been successfully implemented in the past. Refer to Section 4.5.3 for description of removal activity.
	Cost	Very high – >$3 million.	Nil	Very high – >$3 million.	Very high – >$3 million.

4.5.11 Health and Safety Assessment

Infrastructure/ Options	Sub-Criteria	Base case (Complete removal)	Leave in-situ	Rock dumping	Partial Removal
DSPM anchors and chains	**Risk to project personnel offshore**	Medium – anchor chains may have become tangled during lowering operations or anchors may be difficult to dislodge from the seabed, adding complexity to retrieval. Handling on the deck of the dive vessel may be difficult.	Nil – no field activities.	N/A – screened out, refer to Table 4-4.	Nil – no field activities.
	Risk to other marine users	Low – limited activity duration.	Nil – no field activities.	N/A – screened out refer to Table 4-4.	Nil – no field activities.
Umbilical crossing mattresses and grout bags	**Risk to project personnel offshore**	Medium – age of infrastructure poses some challenges to ensure safe lifting. Risks involved with lifting, diving and rigging.	Nil – no field activities.	N/A – screened out, refer to Table 4-4.	Medium – age of infrastructure poses some challenges to ensure safe lifting. Risks involved with lifting, diving and rigging.
	Risk to other marine users	Low – limited activity duration.	Nil – no field activities.	N/A – screened out, refer to Table 4-4.	Low – limited activity duration.
Umbilicals and umbilical jumpers	**Risk to project personnel offshore**	Low – risk of dropping reels during handling and recovery. ROV operations.	Nil – no field activities.	Low – rock dumping of umbilicals and jumpers would be undertaken mechanically and would not directly involve personnel.	Low – risk of dropping reels during handling and recovery. ROV operations.

Infrastructure/ Options	Sub-Criteria	Base case (Complete removal)	Leave in-situ	Rock dumping	Partial Removal
	Risk to other marine users	Low – limited activity duration.	Nil – no field activities.	Low – limited activity duration.	Low – limited activity duration.
Flexible and reinjection flowlines and jumpers	**Risk to project personnel offshore**	Low – risk of dropping reels during handling and recovery. ROV operations.	Nil – no field activities.	Low – rock dumping of flowlines and jumpers would be undertaken mechanically and would not directly involve personnel.	Low – risk of dropping reels during handling and recovery. ROV operations.
	Risk to other marine users	Low – limited activity duration.	Nil – no field activities.	Low – limited activity duration.	Low – limited activity duration.

4.5.12 Environment and Socio-Economic

Infrastructure/ Options	Sub-Criteria	Base case (Complete removal)	Leave in-situ	Rock dumping	Partial Removal
DSPM anchors and chains	**Water quality and sediment impacts**	Medium – turbidity and water quality impacts from lifting the asset off the seabed. Loss of containment from vessel collision is credible but highly unlikely. Sediment and water quality impacts likely from dredging are short term and localised.	Low – corrosion and degradation of chains over time. Chain are primarily comprised of iron, which is non-toxic. Metal corrosion is at a rate of 0.005 to 0.03 mm/year (Atteris, 2021).	N/A – screened out, refer to Table 4-4.	Low – corrosion and degradation of chains over time. Chains primarily comprise iron which is non-toxic. Metal corrosion is at a rate of 0.005 to 0.03 mm/year (Atteris 2021).
	Ecological services	Low – destruction of marine growth on asset and permanent removal of hard substrate. Marine growth is likely to be limited as assets are small in diameter and partially or fully covered by sediment.	Benefit – fish habitat studies have found the subsea infrastructure provides hard substrate for benthic habitat that supports commercially valuable fish stocks (McLean et al. 2021)	N/A – screened out, refer to Table 4-4.	Benefit – fish habitat studies have found that the subsea infrastructure provides hard substrate for benthic habitat that supports commercially valuable fish stocks (McLean et al. 2021).
	Air emissions	Low – vessel emissions to air during site operations and onshore disposal.	Nil – no field activities.	N/A – screened out, refer to Table 4-4.	Nil – no field activities.
	Waste	Medium – vessel discharges and disposal of removed infrastructure on shore.	Nil – no field activities.	N/A – screened out, refer to Table 4-4.	Nil – no field activities.
	Commercial impact on other marine users during activities	Low – limited activity duration. Vessel presence temporarily excludes other marine users.	Nil – no field activities.	N/A – screened out, refer to Table 4-4.	Nil – no field activities.

Infrastructure/ Options	Sub-Criteria	Base case (Complete removal)	Leave in-situ	Rock dumping	Partial Removal
DSPM anchors and chains (continued)	**Residual impact on other marine users**	Low – removal of infrastructure removes any associated fish attracting habitat. DSPM anchors and chains are unlikely to provide significant habitat benefit as they are lying on the seabed (low relief) and small in size.	Low – Fishing effort is low at the Woollybutt field and the Pilbara Trawl Fishery Zone 1 which overlaps the area is currently closed to trawling. Anchors are embedded in a cemented sand/ weak calcarenite layer at 5 to 6 m below the mudline, therefore the risk of snagging is low. Chains are lying on the seabed. Infrastructure left in-situ will also be marked on navigational charts. Therefore, the risk of snagging is considered low, this is discussed is further detail in Section 4.6.1.	N/A – screened out, refer to Table 4-4.	Low – Fishing effort is low at the Woollybutt field and the Pilbara Trawl Fishery Zone 1 which overlaps the area is currently closed to trawling. Anchors are embedded in a cemented sand/ weak calcarenite layer at 5 to 6 m below the mudline, therefore present no snagging risk. Chains are lying on the seabed and are less than 16 cm in diameter, therefore snag risk is low. Infrastructure left in-situ will also be marked on navigational charts. Therefore, the risk of snagging is considered low, this is discussed is further detail in Section 4.6.1.

Infrastructure/ Options	Sub-Criteria	Base case (Complete removal)	Leave in-situ	Rock dumping	Partial Removal
Umbilical and flowline crossing mattresses and grout bags	**Water quality and sediment impacts**	Low – turbidity and water quality impacts from lifting the asset off the seabed. Loss of containment from vessel collision is credible but highly unlikely.	Low- Corrosion and degradation of umbilicals and flowline crossing mattresses and grout has the potential to cause minor localised water quality and sediment impacts. They are predominantly comprised of concrete with small quantities of stabilised copolymer extruded fibre rope. Concrete is chemically inert. 60 to 90% burial of infrastructure is expected in 30 years and degradation of polymers is expected to take 1,000 to 10,000 years (Atteris, 2021). Therefore, impacts are expected to be low. This is discussed in further detail in Sections 4.6.1 and 9.	N/A – screened out, refer to Table 4-4.	Low – turbidity and water quality impacts from lifting the asset off the seabed. Loss of containment from vessel collision is credible but highly unlikely.

Infrastructure/ Options	Sub-Criteria	Base case (Complete removal)	Leave in-situ	Rock dumping	Partial Removal
Umbilical and flowline crossing mattresses and grout bags (continued)	**Ecological services**	Low – destruction of marine growth on asset and permanent removal of hard substrate. Marine growth is likely to be limited as assets are small in diameter and partially or fully covered by sediment.	Benefit – fish habitat studies have found the subsea infrastructure provides hard substrate for benthic habitat that supports commercially valuable fish stocks including cardinal fish (*Apogonidae* spp.), Areolate grouper (*Epinephelus areolatus)* and various snapper species (*Lutjanius quinquelineatus, L.malabaricus, Lutjanus vitta)* (McLean et al. 2021).	N/A – screened out, refer to Table 4-4.	Low – destruction of marine growth on asset and permanent removal of hard substrate. Marine growth is likely to be limited as assets are small in diameter and partially or fully covered by sediment.
	Air emissions	Low – vessel emissions to air during site operations and onshore disposal.	Nil – no field activities.	N/A – screened out, refer to Table 4-4.	Low – vessel emissions to air during site operations and onshore disposal.
	Waste	Medium – vessel discharges and disposal of removed infrastructure on shore.	Nil – no field activities.	N/A – screened out, refer to Table 4-4.	Medium – vessel discharges and disposal of removed infrastructure on shore.
	Commercial impact on other marine users during activities	Low – limited activity duration. Vessel presence temporarily excludes commercial fishers.	Nil – no field activities.	N/A – screened out, refer to Table 4-4.	Low – limited activity duration. Vessel presence temporarily excludes commercial fishers.

Infrastructure/ Options	Sub-Criteria	Base case (Complete removal)	Leave in-situ	Rock dumping	Partial Removal
Umbilical and flowline crossing mattresses and grout bags (continued)	**Residual impact on other marine users**	Low – removal of infrastructure, removes any associated fish attracting habitat. Umbilical and flowline crossing mattresses and grout bags are unlikely to provide significant habitat benefit as they are lying on the seabed (low relief) and small in size.	Low – Fishing effort is low at the Woollybutt field and the Pilbara Trawl Fishery Zone 1 which overlaps the area is currently closed to trawling. Infrastructure left in-situ will also be marked on navigational charts. Therefore, the risk of snagging is considered low, this is discussed further in Section 4.6.1.	N/A – screened out, refer to Table 4-4.	Low – removal of infrastructure removes any associated fish attracting habitat. Umbilical and flowline crossing mattresses and grout bags are unlikely to provide significant habitat benefit as they are lying on the seabed (low relief) and small in size.

Infrastructure/ Options	Sub-Criteria	Base case (Complete removal)	Leave in-situ	Rock dumping	Partial Removal
Umbilicals and umbilical jumpers	Water quality and sediment impacts	Medium – turbidity and water quality impacts from lifting the asset off the seabed. Majority of asset is buried. Loss of containment from vessel collision is credible but highly unlikely.	Low – hydraulic fluids and chemicals will no longer be present in the umbilicals as they were released during the cutting activities covered in the Field Management EP. Corrosion and degradation of umbilicals and umbilical jumpers has the potential to cause localised water quality and sediment impacts. 60 to 90% burial of infrastructure is expected in 30 years and degradation of polymers is expected to take 1,000 to 10,000 years (Atteris, 2021). Therefore, impacts are expected to be low. This is discussed further in Sections 4.6.1 and 9.	Low – turbidity, water quality impacts and seabed disturbance will result from placement of rock aggregate. Corrosion and degradation of umbilicals and umbilical jumpers has the potential to cause localised water quality and sediment impacts. Loss of containment from vessel collision is credible but highly unlikely.	Medium – turbidity and water quality impacts from lifting the asset off the seabed. Majority of asset is buried. Loss of containment from vessel collision is credible but highly unlikely.

Infrastructure/ Options	Sub-Criteria	Base case (Complete removal)	Leave in-situ	Rock dumping	Partial Removal
Umbilicals and umbilical jumpers (continued)	Ecological services	Low – destruction of marine growth on asset and permanent removal of hard substrate. Marine growth is likely to be limited as assets are small in diameter and partially or fully covered by sediment.	Benefit – fish habitat studies have found the subsea infrastructure provides hard substrate for benthic habitat that supports commercially valuable fish stocks, including cardinal fish (*Apogonidae* spp.), Areolate grouper (*Epinephelus areolatus)* and various snapper species (*Lutjanius quinquelineatus, L. malabaricus, Lutjanus vitta)* (McLean et al. 2021).	Low – placement of rock aggregate has the potential to destruct marine growth on the umbilicals and umbilical jumpers. This may be offset as rock aggregate has the potential to act as a hard substrate to facilitate marine growth.	Low – destruction of marine growth on asset and permanent removal of hard substrate. Marine growth is likely to be limited as assets are small in diameter and partially or fully covered by sediment.
	Air emissions	Low – vessel emissions to air during site operations and onshore disposal.	Nil – no field activities.	Low – vessel emissions to air during site operations and onshore disposal.	Low – vessel emissions to air during site operations and onshore disposal.
	Waste	Medium – vessel discharges and disposal of removed infrastructure on shore.	Nil – no field activities.	Low – vessel discharges.	Medium – vessel discharges and disposal of removed infrastructure on shore.
	Commercial impact on other marine users during activities	Low – limited activity duration. Vessel presence temporarily excludes commercial fishers.	Nil – no field activities.	Low – limited activity duration. Vessel presence temporarily excludes commercial fishers.	Low – limited activity duration. Vessel presence temporarily excludes commercial fishers.

Infrastructure/ Options	Sub-Criteria	Base case (Complete removal)	Leave in-situ	Rock dumping	Partial Removal
Umbilicals and umbilical jumpers (continued)	Residual commercial impact on other marine users	Low – removal of infrastructure, removes any associated fish attracting habitat. Umbilicals are unlikely to provide significant habitat benefit as they are lying on the seabed (low relief) and small in size.	Low – Fishing effort is low at the Woollybutt field and the Pilbara Trawl Fishery Zone 1 which overlaps the area is currently closed to trawling. Infrastructure left in-situ will also be marked on navigational charts. Therefore, the risk of snagging is considered low, this is discussed is further detail in Section 4.6.1.	Low – rock dumping would minimise potential snag hazard.	Low – removal of infrastructure, removes any associated fish attracting habitat. Umbilicals and umbilical jumpers are unlikely to provide significant habitat benefit as they are lying on the seabed (low relief) and small in size.

Infrastructure/ Options	Sub-Criteria	Base case (Complete removal)	Leave in-situ	Rock dumping	Partial Removal
Flexible and reinjection flowlines and jumpers	Water quality and sediment impacts	Medium – turbidity and water quality impacts from lifting the asset off the seabed. Majority of asset is buried. Loss of containment from vessel collision is credible but highly unlikely.	Low – hydraulic fluids and chemicals will no longer be present in the flowlines as they were released during the cutting activities covered in the Field Management EP. Corrosion and degradation of flowlines and jumpers has the potential to cause localised water quality and sediment impacts. 60 to 90% burial of infrastructure is expected in 30 years and degradation of polymers is expected to take 1,000 to 10,000 years (Atteris, 2021). Therefore, impacts are expected to be low. This is discussed in further details in Sections 4.6.1 and 9	Low – turbidity, water quality impacts and seabed disturbance will result from placement of rock aggregate. Corrosion and degradation of flowlines and jumpers has the potential to cause localised water quality and sediment impacts. Loss of containment from vessel collision is credible but highly unlikely.	Medium – turbidity and water quality impacts from lifting the asset off the seabed. Majority of asset is buried. Loss of containment from vessel collision is credible but highly unlikely.

Infrastructure/ Options	Sub-Criteria	Base case (Complete removal)	Leave in-situ	Rock dumping	Partial Removal
Flexible and reinjection flowlines and jumpers (continued)	Ecological services	Medium– destruction of marine growth on asset and permanent removal of hard substrate. Currently 95% of the flowlines are unburied. Burial is unlikely to result in the complete loss of colonising benthos although it may change the nature and abundance of colonising benthos (Mclean et at, 2021).	Benefit – Along the flowlines 10216 fish from 40 species and 22 families were observed. The flowlines provides hard substrate for benthic habitat that supports commercially valuable fish stocks, including cardinal fish (*Apogonidae* spp.), Areolate grouper (*Epinephelus areolatus)* and various snapper species (*Lutjanius quinquelineatus, L. malabaricus, Lutjanus vitta)* (McLean et al. 2021).	Low – placement of rock aggregate has the potential to destruct marine growth on the flowlines and jumpers. This may be offset as rock aggregate has the potential to act as a hard substrate to facilitate marine growth.	Low – destruction of marine growth on asset and permanent removal of hard substrate. Marine growth is likely to be limited as assets are small in diameter and partially or fully covered by sediment.
	Air emissions	Low – vessel emissions to air during site operations and onshore disposal.	Nil – no field activities.	Low – vessel emissions to air during site operations and onshore disposal.	Low – vessel emissions to air during site operations and onshore disposal.
	Waste	Medium – vessel discharges and disposal of removed infrastructure on shore.	Nil – no field activities.	Low – vessel discharges.	Medium – vessel discharges and disposal of removed infrastructure on shore.
	Commercial impact on other marine users during activities	Low – limited activity duration. Vessel presence temporarily excludes commercial fishers.	Nil – no field activities.	Low – limited activity duration. Vessel presence temporarily excludes commercial fishers.	Low – limited activity duration. Vessel presence temporarily excludes commercial fishers.

Infrastructure/ Options	Sub-Criteria	Base case (Complete removal)	Leave in-situ	Rock dumping	Partial Removal
Flexible and reinjection flowlines and jumpers (continued)	Residual commercial impact on other marine users	Low – removal of infrastructure, removes any associated fish attracting habitat.	Fishing effort is low at the Woollybutt field and the Pilbara Trawl Fishery Zone 1 which overlaps the area is currently closed to trawling. Infrastructure left in-situ will also be marked on navigational charts. Therefore, the risk of snagging is considered low, this is discussed is further detail in Section 4.6.1	Low – rock dumping would minimise potential snag hazard.	Low – removal of infrastructure, removes any associated fish attracting habitat. To date, ROV footage has not observed significant fish attracting habitat associated with concrete mattresses and grout bags

4.5.13 Comparative Assessment Results

The assessment considered each piece of infrastructure on a stand-alone basis and included a sensitivity analysis for the weighting of the different factors and concluded that leave in situ was the preferred option for each.

4.5.13.1 DSPM Anchors and Chains

Leave in-situ is the preferred decommissioning option for the DSPM anchors and chains. The results of the comparative assessment ranked the technical feasibility of removing the anchors and chains as presenting a high level of complexity, with the potential to cause localised disturbance to water quality and sediments. Removal of the anchors is likely to require excavation using ROVs to dislodge the anchors, which are embedded in a sand/weak calcarenite later 5 to 6 m below the mudline. Once the anchors are dislodged, the chains will be hooked up using ROV(s) to a vessel crane, which will pull the chains and anchor at the same time to dislodge them from the seabed. This has potential to cause turbidity and seabed disturbance. The DSPM anchors and chains are predominantly comprised of steel, which is considered to be non-toxic (Section 9.2.3); therefore, leaving the infrastructure in situ is not expected to cause long-term environmental impacts.

The anchors are embedded in the seabed and the chains are lying on the seabed in 100 m depth of water. Fishing effort is low at the Woollybutt field and the Pilbara Trawl Fishery Zone 1 which overlaps the area is currently closed to trawling, therefore snag risk is currently expected to be low. It is expected that the anchors and chains will self-bury 60-90% over the next 30 years (Atteris, 2021). The anchors and chains will also be marked on navigational charts. Snag risk is also expected to decrease further in the future due to continual improvements in fishery GPS equipment (Rouse, 2020).

4.5.13.2 Flexible and Reinjection Flowlines and Jumpers

Leaving in-situ is the preferred decommissioning option for the flexible and reinjection flowlines and jumpers. The results of the comparative assessment ranked the technical feasibility of removing the flowlines and jumpers as presenting a moderate level of complexity. However, as sections of the flowlines are buried, removal will require excavation using an ROV which will cause localised seabed disturbance and turbidity impacts. The flowlines and jumpers predominantly comprise steel which is non-toxic, with an inner sheath and outer layer comprising polymers (Section 5.8.1.1). Due to the length of the flowlines, there is high removal cost and a large amount of waste requiring onshore disposal. Emissions will also be associated with removal and onshore disposal.

Fish habitat studies undertaken on the flowlines observed 10216 fish from 40 species and 22 families were observed. The flowlines provide hard substrate for benthic habitat that supports commercially valuable fish stocks, including cardinal fish (*Apogonidae* spp.), Areolate grouper (*Epinephelus areolatus)* and various snapper species (*Lutjanius quinquelineatus, L. malabaricus, Lutjanus vitta)* (McLean et al. 2021).

As the flowlines are expected to become 60 to 90% buried over the next 30 years and the degradation of plastic is gradual (degradation 1000 to 10,000 years) (Atteris, 2021), impacts associated with plastic degradation are expected to be localised. Burial to a degree will limit the availability of hard substrate for benthos to attach to and grow,

however benthos can still grow on hard surfaces where they exist just beneath the surface. Burial is unlikely to result in the complete loss of colonising benthos although it may change the nature and abundance of colonising benthos.

The area is currently closed to trawling and fishing effort in the area is low. In the long term, the infrastructure is expected to present a low snag risk as 60 to 90% of it is expected to become buried over the next 30 years (Atteris, 2021). Snag risk is also expected to decrease further in the future due to continual improvements in fishery GPS equipment (Rouse, 2020).

4.5.13.3 Umbilicals and Umbilical Jumpers

Leaving in situ is the preferred decommissioning option for the umbilical and umbilical jumpers. The results of the comparative assessment ranked the technical feasibility of removing the umbilicals and umbilical jumpers as presenting a moderate level of complexity. In addition, as sections of the flowlines have become self-buried, removal of these sections will cause localised seabed disturbance and turbidity impacts. The umbilicals and umbilical jumpers are comprised of steel which is non-toxic. They also contain plastic components: the outer sheath, inner sheath, cable filler and cable outer (detailed further in Section 5.7). As the umbilicals are expected to become 60 to 90% buried over the next 30 years and the degradation of plastic is gradual (degradation 1000 to 10,000 years) (Atteris, 2021), impacts associated with leaving the infrastructure in situ are expected to be localised.

The area is currently closed to trawling and fishing effort in the area is low. In the long term, the infrastructure is expected to present a low snag risk as 60 to 90% of it is expected to become buried over the next 30 years (Atteris, 2021). Snag risk is also expected to decrease further in the future due to continual improvements in fishery GPS equipment (Rouse, 2020).

4.5.13.4 Umbilical Crossing Mattresses and Grout Bags

Leaving in situ is the preferred decommissioning option for the umbilical crossing mattresses and grout bags. The results of the comparative assessment ranked the technical feasibility of removing the umbilical crossing mattresses and grout bags as presenting a low level of complexity. However, due to the age and condition of the infrastructure, the risk to personnel associated with lifting was assessed as medium.

The umbilical crossing mattresses and grout predominantly comprise concrete with minor amounts of polymers. As concrete is inert, leaving the infrastructure in situ is expected to cause only slight environmental impacts.

The area is currently closed to trawling and fishing effort in the area is low. In the long term, the infrastructure is expected to present a low snag risk as 60 to 90% of it is expected to become buried over the next 30 years (Atteris, 2021). Snag risk is also expected to decrease further in the future due to continual improvements in fishery GPS equipment (Rouse, 2020).

4.6 Equal or Better Outcomes Assessment

An equal or better outcomes assessment was undertaken to determine whether any alternate option presents equal or better environmental outcomes when compared to the base case of full removal (DIIS, 2018). Refer to Section 4.5. This equal or better outcomes assessment involved a detailed assessment of all the potential environmental risk and benefits of the options and an assessment of the options in accordance with the principles of ESD.

4.6.1 Environmental Risks and Impacts

The environmental impacts and risks (beneficial and adverse) associated with each decommissioning option are assessed in Table 4-9. The environmental impacts and risks were assessed in accordance with EAL's Risk Assessment process outlined in Section 8.

Potential beneficial impacts have been identified but not ranked.

The assessment of environmental impacts and risks (Table 4-9) also considers the timeframe of the impact and risk. The following definitions have been used:

- Short-term – impact or risk during decommissioning operations (one to two years)
- Medium-term – impact or risk following decommissioning operations, until the infrastructure degrades (two to 500 years)
- Long-term – impact or risk beyond medium-term at which the infrastructure has reached a steady state, determined to be completely degraded (beyond 500 years).

Table 4-9: Environmental impact and risk assessment of decommissioning options

Impact/risk	Impact risk description	Timeframe	Impact/risk and/or benefit of decommissioning options			
			Complete removal (Base case)	**Leave in situ**	**Rock dumping**	**Partial removal**
Evaluation of planned activities						
Interaction with other users	Potential for vessels used for decommissioning activities to interact with or displace other users (commercial fisheries, shipping and defence).	Short-term – during decommissioning operations	**Low** Several State and Commonwealth managed fisheries overlap the Operational Area (Section 6.3.1). The presence of a vessel used for decommissioning activities may restrict the use of the area by commercial fishers. However, because the vessel will be in the area for short periods over a defined amount of time, and because the fisheries' areas extend beyond the area, the likelihood of interaction with commercial fisheries is low. No recreational fishing occurs in the area. No shipping fairways intersect the Operational Area. AMSA data also indicates vessel density in the area is low. Based on this and the short duration of the activity, the likelihood of decommissioning vessel interaction with shipping is low. A Department of Defence practice area also intersects the Operational Area. However, due to the temporary nature of the decommissioning activity, the likelihood of interaction is low.	**Low** No activities would be required and therefore there would be no interactions with other users.	**Low** The duration of rock dumping activities would be similar to or slightly less than the full removal option.	**Low** Partial removal would encounter similar conditions to full removal but likely to occur over a shorter time span.
	Potential economic benefit to commercial fishers associated with opportunity for increased catch.	Medium-term – the period following decommissioning operations until the infrastructure reaches steady state.	**N/A** Complete removal of infrastructure results in complete removal of associated benthic habitat so no benefit to commercial fishing.	**Benefit** Fish ecology studies have been undertaken on the Woollybutt flowlines observed 10216 fish from 40 species and 22 families. This included 1794 fishery target fish representing 19 species at a density of 195 fishery target fish per 1 km of flowline (McLean et al. 2021). Retaining the infrastructure in situ has the potential to provide economic benefit to commercial fishers in the medium-term, through attraction of commercial fish species due to creation of hard substrate habitat on an otherwise featureless seabed.	**Benefit** Initial rock placement has the potential to damage benthic habitat growth on infrastructure. Over time, the rock aggregate would act as a hard substate that could facilitate marine growth.	**Benefit** Fish ecology studies have been undertaken on the Woollybutt flowlines by McLean et al. (2021). Initial studies results showed commercially fished species associating with the flowlines. Retaining flowline infrastructure in situ has the potential to provide economic benefit to commercial fishers in the medium-term, through attraction of commercial fish species due to creation of hard substrate habitat on an otherwise featureless seabed.

Impact/risk	Impact risk description	Timeframe	Impact/risk and/or benefit of decommissioning options			
			Complete removal (Base case)	**Leave in situ**	**Rock dumping**	**Partial removal**
Disturbance to seabed and benthic habitat	Decommissioning activities such as dredging, trenching, recovery and ROV operations have the potential to damage the seabed and benthic habitats.	Short-term - during decommissioning operations	**Low** Excavating partially buried infrastructure, dredging around infrastructure (such as DSPM anchors) and subsequent removal of the infrastructure from the seabed is likely to result in disturbance to seabed and associated benthic habitat. Seabed disturbance will be localised, limited to the immediate vicinity of the infrastructure. The excavation and dredging activities have the potential to cause localised, short-term elevated turbidity in the water column, resulting in the clogging of respiratory and feeding parts of filter-feeding organisms. The seabed in the Operational Area predominantly comprises soft sediments with epibenthic flora and fauna. The nearest mangroves and hard coral are found at Barrow Island, 40 km north-east. The seabed and communities found within the Operational Area are common to the broader region. Impacts to the seabed, benthic habitats and water quality as a result of decommissioning activities are expected to be short-term and localised.	**N/A** No activities would be required and therefore there would be no disturbance to the seabed.	**Low** Rock dumping is likely to result in localised temporary disturbance to seabed and benthic habitat. The duration of the activity is likely to be similar to or slightly less than the full removal option.	**Low** Excavating partially buried infrastructure for the removal of mattresses, grout bags, umbilicals and umbilical jumpers and flowlines and flowline jumpers from the seabed is likely to result in disturbance to seabed and benthic habitat similar to impacts of full removal, albeit no dredging activities are proposed. Seabed disturbance will be negligible and relate to a confined and temporary impact on the area in the immediate vicinity of the infrastructure to be removed. No activities would be required for anchors, chains which would be left in situ. As such, no disturbance would occur in relation to leaving this infrastructure in place.
Subsea discharges from corrosion and degradation (concrete and metals)	Corrosion and degradation as a result of infrastructure being left in-situ permanently.	Long-term – the period beyond medium-term at which the infrastructure has reached a steady state	**N/A** No infrastructure will remain in situ	**Low** During equipment recovery (covered in the Field Management EP), the flowlines and umbilicals will be severed from subsea equipment. This will result in the contents (seawater treated with Hydrosure O-3670R) being released to the marine environment. The impacts of fluid release are covered in the Field Management EP. It is assumed the entire volume of treated seawater will be released during the equipment recovery activities; therefore, the impact of fluid release is not assessed here. The infrastructure comprises concrete, steel and plastic. The DSPM anchors and chains comprise steel, which is mainly comprised of iron (~98%). Iron is not considered a significant contaminant in the marine environment and is only toxic to marine organisms at extremely high concentrations (Grimwood	**Low** Infrastructure rock dumped still has the potential to corrode and degrade overtime, as described for the leave in situ option.	**Low** Infrastructure comprised wholly of metals (DSPM anchors and chains) left in-situ will corrode and degrade over time. Based on the low toxicity of steel and the slow degradation rate, impacts are expected to be localised and slight. Infrastructure that contains plastic (umbilical crossing mattresses and grout bags; umbilicals and umbilical jumpers, flowlines and flowlines jumpers) will be removed.

Impact/risk	Impact risk description	Timeframe	Impact/risk and/or benefit of decommissioning options			
			Complete removal (Base case)	**Leave in situ**	**Rock dumping**	**Partial removal**
				and Dixon, 1997). It is also considered to pose little or no risk to the environment. The steel components of the flowlines and umbilicals are also predicted to degrade at low rate 0.005 to 0.03 m^3/year (Atteris, 2021). The umbilical mattress and grout bags predominantly comprise concrete with minor amounts of polymers. Although the exact composition of the concrete in the Woollybutt field infrastructure is unknown, concrete is usually chemically inert, and products released from concrete during corrosion and degradation over time will not react in the marine environment (Atteris, 2021). 60-90% of polymers are expected to become buried over the next, 30 years. Polymers are expected to take 1000 to 10,000 years to break down. Based on the degradation and burial rates, small quantities of plastic are expected to enter the marine environment. Based on the low toxicity of steel and concrete and the slow degradation rate, impacts are expected to be localised and slight.		
Release of plastic as a result of corrosion and degradation	Corrosion and degradation as a result of infrastructure being left in-situ permanently.	Long-term – the period beyond medium-term at which the infrastructure has reached a steady state	**N/A** No infrastructure will remain in situ.	**Low** The Woollybutt infrastructure contains polymers that are expected to break down and enter the marine environment. The breakdown of this material has been modelled by Atteris (2021), which shows that the infrastructure will self-bury between 60 to 90% and polymers will break down over a period of up to 1000 to 10,000 years. The polymers that break down from the buried sections of the infrastructure are likely to remain buried and localised. However, 10 to 40% of plastics will enter the marine environment. Because the plastics will break down slowly over a long period of time, the impacts are expected to be slight over a longer timeframe.	**Low** The Woollybutt infrastructure contains polymers that have potential to break down and enter the marine environment. However, burying the flowlines and umbilicals which contain polymers through rock dumping will prevent some of the degraded plastic being released to the marine environment.	**N/A** Infrastructure that contains plastic material (umbilical crossing mattresses and grout bags; umbilicals and umbilical jumpers, flowlines and flowline jumpers) will be removed.
Underwater noise	Generation of underwater noise from vessels and atmospheric noise from helicopter transfers.	Short-term - during decommissioning operations	**Low** Vessel and helicopters will generate noise both in the air and underwater during decommissioning activities. The main source of noise from a DP (dynamic positioning) vessel relates to the use of thrusters. Listed threatened and listed migratory species that could be potentially impacted by noise and	**N/A** No activities would be required and therefore there would be no underwater noise.	**Low** The duration of rock dumping activities would be similar to or slightly less than the full removal option.	**Low** Partial removal would encounter similar conditions to full removal but likely to occur over a shorter time span.

Impact/risk	Impact risk description	Timeframe	Impact/risk and/or benefit of decommissioning options			
			Complete removal (Base case)	**Leave in situ**	**Rock dumping**	**Partial removal**
			vibration which may be present within the Operational Area primarily include cetaceans, whale sharks and turtles. The Operational Area overlaps a portion of the pygmy blue whale distribution biologically important area (BIA), the humpback whale migration BIA and the flatback turtle 73nteresting buffer. Given the noise levels associated with routine operations of the vessel, the potential impacts are unlikely to be significant. It is reasonable to expect that fauna may demonstrate avoidance or attraction behaviour to the noise generated by the vessel and helicopter activities. It is considered that noise generated by the vessel and helicopters will result in short-term localised impacts to marine fauna in the immediate area.			
Routine and non-routine discharges from the vessel	Routine discharges from the vessel (sewage, grey water, putrescible wastes, deck and bilge water, cooling water or brine) to the marine environment.	Short-term - during decommissioning operations	**Low** The vessel will routinely generate/ discharge small volumes of treated sewage, putrescible wastes and grey water to the marine environment. It will also routinely/periodically discharge relatively small volumes of bilge water, and discharge deck drainage directly overboard or overboard via deck drainage systems. Cooling water is discharged from machinery engine units and brine water is produced during the desalination process of reverse osmosis to produce potable water onboard the vessel. Routine and non-routine discharges will be temporary and intermittent in nature for the duration of the decommissioning activities. It is possible that marine fauna transiting the area may come into contact with these discharges (such as marine turtles, pygmy blue whales and whale sharks), as they traverse the Operational Area. However, it is expected that the small volumes of discharges will be rapidly diluted and dispersed in the open water marine environment. Therefore, impacts are expected to be localised and short-term.	**N/A** No activities would be required and therefore there would be no discharges from vessels.	**Low** The duration of rock dumping activities would be similar to or slightly less than the full removal option.	**Low** Partial removal would encounter similar conditions to full removal but likely to occur over a shorter time span.

Impact/risk	Impact risk description	Timeframe	Impact/risk and/or benefit of decommissioning options			
			Complete removal (Base case)	**Leave in situ**	**Rock dumping**	**Partial removal**
Atmospheric emissions	Internal combustion engines and incinerators on the vessel used for decommissioning.	Short-term - during decommissioning operations	**Low** Atmospheric emissions will be generated by the vessel from internal combustion engines (including all equipment and generators) and incineration activities (including on-board incinerators). Emissions will include SO_2, NO_x, ozone-depleting substances, CO_2, particulates and volatile organic compounds. Given the short duration of the activity and the exposed location of the Operational Area, rapid dispersion of the low volumes of atmospheric emissions in an offshore environment is expected. Therefore, impacts are expected to be localised and short-term.	**N/A** No activities would be required and therefore there would be no emissions.	**Low** The duration of rock dumping activities would be similar to or slightly less than the full removal option.	**Low** Partial removal would encounter similar conditions to full removal but likely to occur over a shorter time span.
Light emissions	External lighting onboard the vessel used for decommissioning.	Short-term - during decommissioning operations	**Low** Artificial lighting can cause a change in the behaviour of fauna, particularly nesting turtles and birds. The main implication of artificial lighting from offshore vessels for marine turtles is the disruption of hatchling sea-finding behaviour, as hatchlings can be disoriented if lights or atmospheric glow occurs out at sea. As the Operational Area is located approximately 35 km from the nearest turtle nesting beach at Barrow Island, light emissions from vessels are not expected to affect the sea-finding behaviour of hatchling turtles. A BIA for wedge-tailed shearwater foraging (during breeding) overlaps the Operational Area (Section 6), with the breeding period occurring from August to April. The risk associated with collision from seabirds attracted to the light is considered to be low, given that there is no critical habitat for these species within the Operational Area. Light emissions from vessels have the potential to cause slight temporary impacts to EPBC-listed species.	**N/A** No activities would be required and therefore there would be no emissions.	**Low** The duration of rock dumping activities would be similar to or slightly less than the full removal option.	**Low** Partial removal would encounter similar conditions to full removal but likely to occur over a shorter time span.

Impact/risk	Impact risk description	Timeframe	Impact/risk and/or benefit of decommissioning options			
			Complete removal (Base case)	**Leave in situ**	**Rock dumping**	**Partial removal**
Unplanned Activities						
Introduction of invasive marine species (IMS)	Introduction of IMS from Decommissioning vessels.	Short-term - during decommissioning operations	**Medium** The deep offshore open waters of the Operational Area are not conducive to the settlement and establishment of IMS. The Operational Area is in water depths of approximately 100 m, precluding light penetration to the seabed, distant from any coastline (more than 30 km) and more than 12 NM from shorelines and/or critical habitat. The likelihood that any marine organisms could become established at the field is rare. Once introduced, IMS have the potential to outcompete indigenous species for food, space or light and can also interbreed with local species, creating hybrids such that the endemic species is lost. These changes to the local marine environment result in changes to the natural ecosystem. Therefore, the risk associated with IMS introduction is classified as medium.	**N/A** No activities would be required and therefore there would be no risks from IMS introductions.	**Medium** The duration of rock dumping activities would be similar to or slightly less than the full removal option.	**Medium** Partial removal would encounter similar conditions to full removal but likely to occur over a shorter time span.
Accidental hydrocarbon release as a result of vessel collision	Loss of <500 m^3 diesel to the marine environment resulting from a vessel collision event.	Short-term - during decommissioning operations	**Low** Vessel collision resulting in a release of marine diesel would see a mixture of both volatile and persistent hydrocarbons released to the marine environment. Given the ocean and weather conditions of the NWS, it is likely the spill would undergo rapid spreading and evaporative loss. Therefore, the spill is likely to dissipate rapidly. Potential impacts to marine species may be caused, including behavioural impacts, sub-lethal biological effects and, in rare circumstances, lethal biological effects. The Operational Area overlaps with BIAs for humpback whales, wedge-tailed shearwater, whale sharks and the flatback turtle. Some marine turtles may be exposed to patchy occurrences of low concentrations of entrained hydrocarbons. There is also potential for lethal and sub-lethal impacts to turtles in the offshore waters near the release site; however, given the	**N/A** No activities would be required and therefore there would be no risks of vessel spills.	**Low** Risks would be as per complete removal.	**Low** Risks would be as per complete removal.

Impact/risk	Impact risk description	Timeframe	Impact/risk and/or benefit of decommissioning options			
			Complete removal (Base case)	**Leave in situ**	**Rock dumping**	**Partial removal**
			depth of the Operational Area and the distance from the nearest nesting beaches (on Barrow Island), this may only affect small numbers of individuals. Impacts to wedge-tailed shearwaters and other seabirds may include mortality due to oiling of feathers or ingestion of hydrocarbons. However, it is also expected that this would only occur in small numbers due to the location of the Operational Area. Whales and whale sharks are likely to display behavioural impacts by avoiding the area that the spill impacts. A hydrocarbon release as a result of a vessel collision is rare and if it occurred would result in minor, short-term impacts to species and habitat.			
Minor hydrocarbon or chemical release	Accidental release of minor quantities of other hydrocarbons and chemicals from the deck of project vessels and equipment (e.g. ROVs and cranes).	Short-term - during decommissioning operations	**Low** An unplanned release of hydrocarbons/chemicals from vessels or equipment will result in a decrease in water quality in the immediate area of the spill. This has potential to cause minor impacts to marine megafauna, particularly humpback whales and whale sharks which have BIAs that overlap the Operational Area (impact could include ingestion and irritation). It could also impact plankton and fish populations (surface and water column biota) in the immediate vicinity of the spill. The likelihood of unplanned discharges from deck and subsea spills is credible and may result in slight, short-term impacts to species and habitat.	**N/A** No activities would be required and therefore there would be no risks of spills.	**Low** Risks would be as per complete removal.	**Low** Risks would be as per complete removal.

Impact/risk	Impact risk description	Timeframe	Impact/risk and/or benefit of decommissioning options			
			Complete removal (Base case)	**Leave in situ**	**Rock dumping**	**Partial removal**
Accidental loss of non-hazardous and hazardous waste	Accidental loss of solid wastes from vessels including hazardous and non-hazardous waste. This excludes sewage, grey water, putrescible waste and bilge water.	Short-term - during decommissioning operations	**Low** The potential impacts of solid wastes accidentally discharged to the marine environment includes direct pollution and contamination of the environment and secondary impacts relating to potential contact of marine fauna with wastes, resulting in entanglement or ingestion and leading to injury and death of individual animals. The likelihood of accidental loss of solids waste is credible and may result in slight, short-term impacts to species and habitat.	**N/A** No activities would be required and therefore there would be no risks of accidental loss of waste.	**Low** Risks would be as per complete removal.	**Low** Risks would be as per complete removal.
Vessel collisions with marine fauna	Accidental collision between a project vessel and protected marine fauna.	Short-term - during decommissioning operations	**Low** Although project vessels are likely to be slow moving or stationary during removal activities, there is potential for vessel collision with marine fauna and cause death, or for marine fauna to be caught in thrusters. The Operational Area overlaps with BIAs for marine turtles, whale sharks and humpback whales; therefore, there is increased potential that these species could be present in the Operational Area. However, given the speed that vessels are likely to be moving, it is unlikely interactions would occur. A vessel collision with marine fauna is unlikely and may result in slight, short-term impacts to species and habitat.	**N/A** No activities would be required and therefore there would be no risks of vessel collisions.	**Low** Risks would be as per complete removal.	**Low** Risks would be as per complete removal.
Unplanned seabed disturbance	Dropped objects during infrastructure removal could result in disturbance to the seabed and benthic habitats.	Short-term - during decommissioning operations	**Low** As infrastructure is being lifted to vessels, there is a potential it could drop back to the seabed and cause seabed disturbance. There is potential for this to occur with all infrastructure that is present. The seabed and benthic habitat in the Operational Area is not particularly sensitive, as it mostly comprises sandy sediments and any communities that are present are largely represented in the region. Dropped objects may result in elevated turbidity and clogging of respiratory and feeding parts of filter-feeding organisms.	**N/A** No activities would be required and therefore there would be no risks of seabed disturbance.	**Low** Risks would be as per complete removal.	**Low** Risks would be as per complete removal.

Impact/risk	Impact risk description	Timeframe	Impact/risk and/or benefit of decommissioning options			
			Complete removal (Base case)	**Leave in situ**	**Rock dumping**	**Partial removal**
			The risk of dropped objects is unlikely and would result in temporary negligible impacts to benthic communities			
Interaction with other users	Physical presence of infrastructure-Interference with other users (commercial and recreational fisheries, shipping and defence)	Medium-term – the period following decommissioning operations until the infrastructure reaches steady state.	**N/A**	**Low**	**Low**	**Low**
			As there would be no infrastructure remaining *in situ*, this removes any potential impacts to third party activities from the presence of the infrastructure	The physical presence of infrastructure may result in accidental damage to trawling nets as a result of snagging. Fishing effort is low at the Woollybutt field and the Pilbara Trawl Fishery Zone 1 which overlaps the area is currently closed to trawling, therefore snagging on infrastructure is not expected to occur in the short term as the area is closed to trawling. Should the area reopen to trawling the risk of snagging is also likely to be low as the infrastructure is expected to self-bury 60-90% over the next 30 years. The infrastructure will also be marked on navigation charts. The Pilbara Trawl Fishery is equipped with echo sounders and GPS plotter which will enable them to avoid infrastructure if required. Snag risk is also expected to decrease further in the future due to continual improvements in fishery GPS equipment (Rouse, 2020). NWS shipping density data provided AMSA confirms that shipping traffic intersecting the Operational Area is low. The Operational Area is located within a defence practice area. The Department of Defence has confirmed operations would not interact with infrastructure left in situ.	The risk of snagging would be reduced as rocks would be dumped over the infrastructure.	As per the leave in situ option, the remaining infrastructure has the potential to cause a snag hazard. However, as the infrastructure will be partially buried and marked on navigational charts the risk of snagging is low.

4.7 Stakeholder Perspectives

EAL have consulted with a range of relevant stakeholders including Commonwealth and State agencies and departments, government agencies, fishing industry bodies and all relevant fishing licence holders. Consultation is summarised in Section 7. In most cases no concerns were raised. Western Australian Fishing Industry Council (WAFIC) outlined their preference is for complete removal of all infrastructure, consultation with WAFIC is ongoing.

4.8 Principles of Ecologically Sustainable Development

As outlined in Section 3A of the EPBC Act, the titleholder needs to ensure the activity is undertaken in a manner consistent with the principles of ESD. The equal or better environmental outcomes evaluation assesses the activity against the relevant principles of ESD, as shown in Table 4-10.

Table 4-10: Assessment of the decommissioning options against the Principles of Ecologically Sustainable Development

Principles of ESD	Assessment of each option against Principles of ESD			
	Complete removal (Base case)	**Leave in situ**	**Rock dumping**	**Partial removal**
Decision-making processes should effectively integrate both long-term and short-term economic, environmental, social and equitable considerations (the 'integration principle').	The Decommissioning Options Assessment process assessed the long-term and short-term environmental and social aspects associated with each option. The outcomes of this assessment are summarised in Section 4.			
If there are threats 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').	There is no threat of serious or irreversible damage associated with complete removal of infrastructure.	There is a low risk as a result of plastic degradation associated with leaving the infrastructure in situ (flowlines and umbilicals). Plastics within the umbilicals and flowlines will break down slowly over a long period of time, the impacts are expected to be slight over a longer timeframe (Table 4-9). Whilst the release of plastics to the marine environment is irreversible, given the volume released the impact is not determined serious.	Rock dumping is likely to result in localised disturbance to seabed and benthic habitat (Table 4-9). Whilst rock dumping to the marine environment is irreversible, the impact is not determined serious given the low sensitivity seabed habitat. Burying the flowlines and umbilicals through rock dumping will prevent some of the degraded plastic being released to the marine environment. Whilst the release of plastics to the marine environment is irreversible, given the volume released the impact is not determined serious.	Infrastructure comprised wholly of metals (DSPM anchors and chains) left in-situ will corrode and degrade over time. Based on the low toxicity of steel, the slow degradation rate and a vast number of steel constituents being present naturally in the marine environment, dispersing in the marine environment to baseline levels over time. Impacts are not determined serious or irreversible.
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').	Removal of infrastructure removes any potential impact associated with long-term degradation of the infrastructure or interference with other users.	Leaving the infrastructure in situ has the potential to provide habitat for fish in a predominantly featureless, soft substrate environment and increase the abundance of fish, including commercially retained species. This provides an enhanced benefit to future generations in the medium-term before degradation of the infrastructure occurs (Table 4-9). The plastics within the umbilicals and flowlines will break down slowly over a long period of time, however, particularly give the slow rate of release, the volumes released are not determined to reduce the health, diversity and productivity of the environment for future generations.	Initial rock placement has the potential to damage benthic habitat growth on infrastructure. The rock aggregate would act as a hard substate that could facilitate marine growth over time. Burying the flowlines and umbilicals through rock dumping will prevent some of the degraded plastic being released to the marine environment. Particularly, given the slow rate of release the volumes of plastic released is not determined to reduce the health, diversity and productivity of the environment for future generations.	Infrastructure comprised wholly of metals (DSPM anchors and chains) left in-situ will corrode and degrade over time. The release of the constituents is low toxicity and will disperse in the marine environment to baseline levels over time. The release is not determined to reduce the health, diversity and productivity of the environment for future generations.
The conservation of biological diversity and ecological integrity should be a fundamental consideration in decision-making (the 'biodiversity principle').	Table 4-9 includes biological diversity and ecological integrity considerations. This risk has been considered in the decommissioning final decision making / recommendation (Section 3.10)			

4.9 Decommissioning Options Assessment Summary

The outcomes of the decommissioning options assessment including the comparative assessment are summarised in Table 4-11. This summary combines the results of the comparative assessment and the equal or better outcomes for all the infrastructure. The highest risk ranking is used in each case to be conservative.

Table 4-11: Summary of the decommissioning options assessment

Option	Comparative Assessment outcomes			Equal or Better Outcomes Assessment		
	Technical and economic	Health and safety	Environment and socio-economic	Short-term	Medium-term	Long-term
Complete removal (base case)	Medium-High	Medium	Medium	Medium	N/A – no impacts	N/A – no impacts
Leave in situ	Low	N/A – no impacts	Low	Low	Low	Low
Rock dumping	Low	Low	Low	Medium	Low	Low
Partial removal	Medium	Medium	Medium	Medium	Low	Low

4.10 Recommendation

Based on the outcomes of the comparative assessment the preferred option with the lowest risk ranking is leave in-situ. Although they are ranked low, the technical/economic and safety risk associated with rock dumping would be higher than those associated with leave in-situ as the duration of the rock-dumping activity is longer than the leave in-situ activity. The environmental risks would also be higher as the activity duration is longer for rock dumping, with more seabed disturbance.

Based on the outcomes of the equal or better outcomes assessment the short- and medium-term impacts of complete removal outweigh the long-term impact of leaving in-situ. The long-term impact from the leave in-situ option relates to the degradation of plastics in the marine environment. Degradation modelling indicated that 60-90% of the infrastructure will become buried over the next 30 years and that polymers will take in the order or 1000 to 10, 000 years to degrade (Atteris, 2021). On this basis is considered that leaving the infrastructure in situ delivers an equal environmental outcome overall

The infrastructure is located within Zone 1 of the Pilbara Trawl Fishery which is currently closed to trawling.

The leave in situ decommissioning option meets the requirements of Section 572(3) and Section 270(3) (C) of the OPGGS Act, which allows for the consideration of alternatives to the base case of complete removal. The leave in-situ option is also not inconsistent with the relevant principles of ESD. Therefore, EAL proposes to leave infrastructure in-situ.

5 DESCRIPTION OF THE ACTIVITY

5.1 Overview

This section has been prepared in accordance with Regulation 13(1) of the OPGGS(E) Regulations and described petroleum activities to be undertaken in accordance with this EP.

The Woollybutt field is located in Permit Area WA-25-L, approximately 65 km north of Onslow and 35 km west of Barrow Island. The field was discovered in 1997 and lies on the continental shelf in 100 m water depth. It produced crude (49°API) with a low gas-to-oil ratio of 135 scf/MMbbl.

The activity involves decommissioning all infrastructure remaining at the Woollybutt field, which includes:

- DSPM anchors and chains
- Umbilical and flowline crossing mattresses and grout bags
- Umbilicals and umbilical jumpers
- Flexible and reinjection flowlines and jumpers.

5.2 Location and History

The Woollybutt field is located in Permit Area WA-25-L, approximately 65 km north of Onslow and 35 km west of Barrow Island. The field was discovered in 1997 and lies on the continental shelf in 100 m water depth. It produced crude (49°API) with a low gas-to-oil ratio of 135 scf/MMbbl.

The Woollybutt field was developed in three stages:

1. The original field development began as a two-well tie-back to the Woollybutt FPSO, Four Vanguard in 2003. These two wells were Woollybutt-1A (WBT1A) and Woollybutt-2A-ST1 (WBT2A ST1).
2. The Scalybutt-1 (SBT1) well was added in 2005 and a new Scalybutt manifold (SBT1 manifold) was installed near the WB2A ST1 well. The flowlines and control umbilical to and from the FPSO were reconfigured to connect WBT2A ST1 directly to the new manifold. Separate flowlines and control umbilicals from WBT2A ST1 and SBT1 were then run from these wells to the new manifold. WBT1A ST1 remained unchanged and was directly connected to the FPSO.
3. The Woollybutt-4 (WBT4) and Woollybutt-6 (WBT6) wells were added in 2008. The results from WBT6, when drilled, were found to be less productive than expected and WBT6 was not completed. Only WBT4 was tied back to the SBT1 manifold. The production fluid from WBT4, WBT2A ST1 and SBT1 were commingled at the SBT1 manifold and routed to the FPSO through the single 6-inch flexible flowline and riser. Similarly, gas lift was distributed from the FPSO via a single 2-inch flowline system and riser to the SBT1 manifold, and then to each well. A control distribution unit was installed at the WBT2A ST1 location to assume control of the SBT1 and WBT2A ST1 wells and to provide dual redundancy in the operation of the subsea control system.

Production ceased in 2012 and all associated subsea equipment remained in situ while P&A and decommissioning activities were planned for.

5.3 Operational Area

The Operational Area defines the spatial boundary of the Petroleum Activities Program, as described, risk assessed and managed by this EP. The Operational Area encompasses the infrastructure that is proposed to be left in situ with and within a 1 km (1000 m) radius around it (Figure 5-1).

A 500 m Petroleum Safety Zone (PSZ) is currently in place around the DSPM and wellheads, the umbilical and flowlines lie partially within this PSZ.

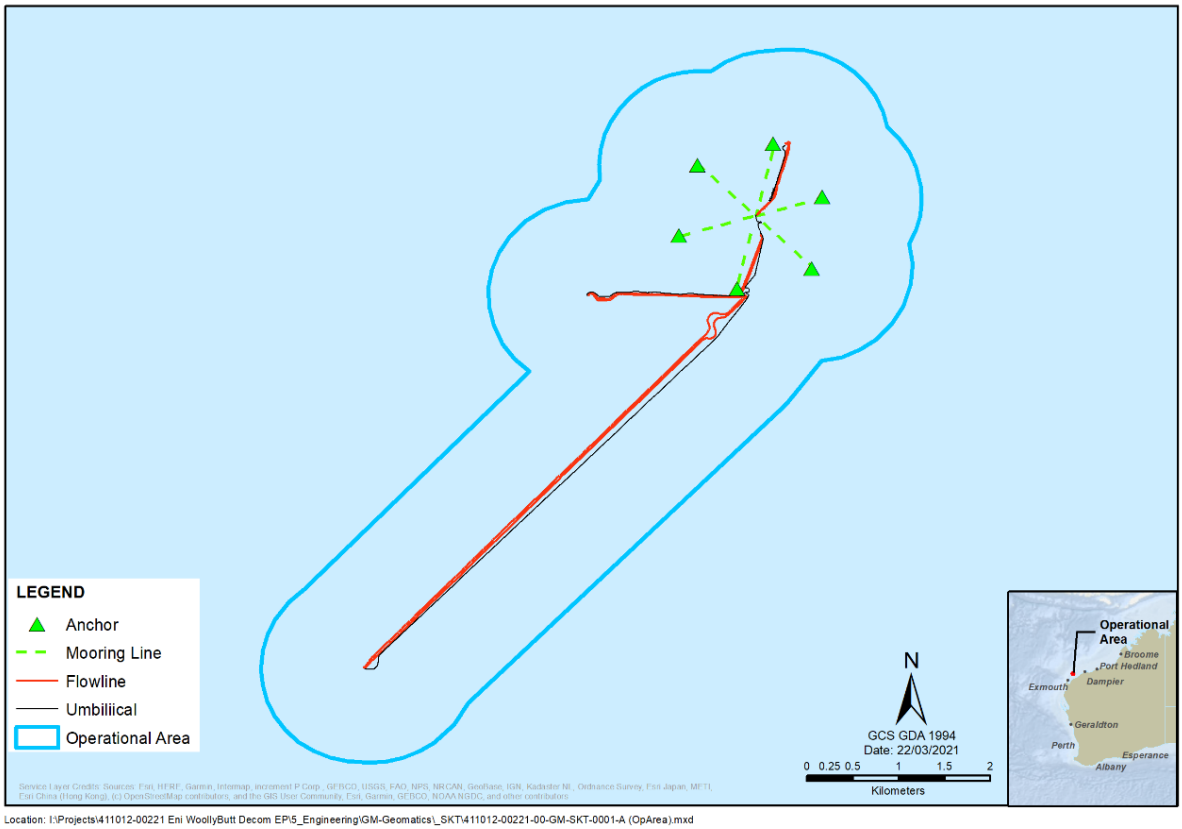

Figure 5-1: Operational Area

5.4 Schedule

The Petroleum Activities Program is expected to commence upon acceptance of this EP. As no field activities are planned, EAL also proposes the activities are considered to have been completed once the environmental performance standards have been met and closed out.

5.5 Decommissioning Strategy

EAL proposes to decommission remaining Woollybutt field infrastructure in situ. This decommissioning strategy has been developed based on the outcomes of the options assessment described in Section 4.9.

Infrastructure that this decommissioning strategy applies to is described in Section 5.7.

5.6 Summary of Field Management and Plug and Abandon Activities

Field management, P&A activities, the removal of certain subsea infrastructure and wellheads and leaving the Corkybark-1 wellhead in situ is covered under a separate Field Management EP. Activities will have been completed by the time the decommissioning activities under this EP are to be performed.

Any cutting and placement of infrastructure will also be conducted under the Field Management EP and therefore no infrastructure preparation activities are proposed under this EP.

Similarly, field surveys, decommissioning studies and fish habitat studies have been commissioned by EAL and field activities associated with these studies have been completed.

5.7 Description of Infrastructure

5.7.1 Disconnectable Single Point Mooring Anchors and Chains

Six anchors and chains were installed for mooring the FPSO via a DSPM buoy. The anchors remain located at a horizontal distance of 780 m from the centre of the buoy and each leg had a total length of approximately 850 m. Chain diameter ranges from 92 mm to 162 mm. Anchor dimensions are approximately 8.1 m long, 2.9 m wide and 3.1 m in length, and have a unit weight of approximately 35.5 te.

The DSPM and chains currently sit on the seafloor. As part of the activities under the Field Management EP, the chains will be cut from the DSPM and placed on the seabed, while the DSPM will be removed from the field.

The composition of the anchors and chains is steel. The anchors are coated in shipcoat steel paint, used to protect metal surfaces, which has a thickness of 25 to 40 mu (standard thickness is one coat).

Figure 5-3 shows the current state of the anchors and chains.

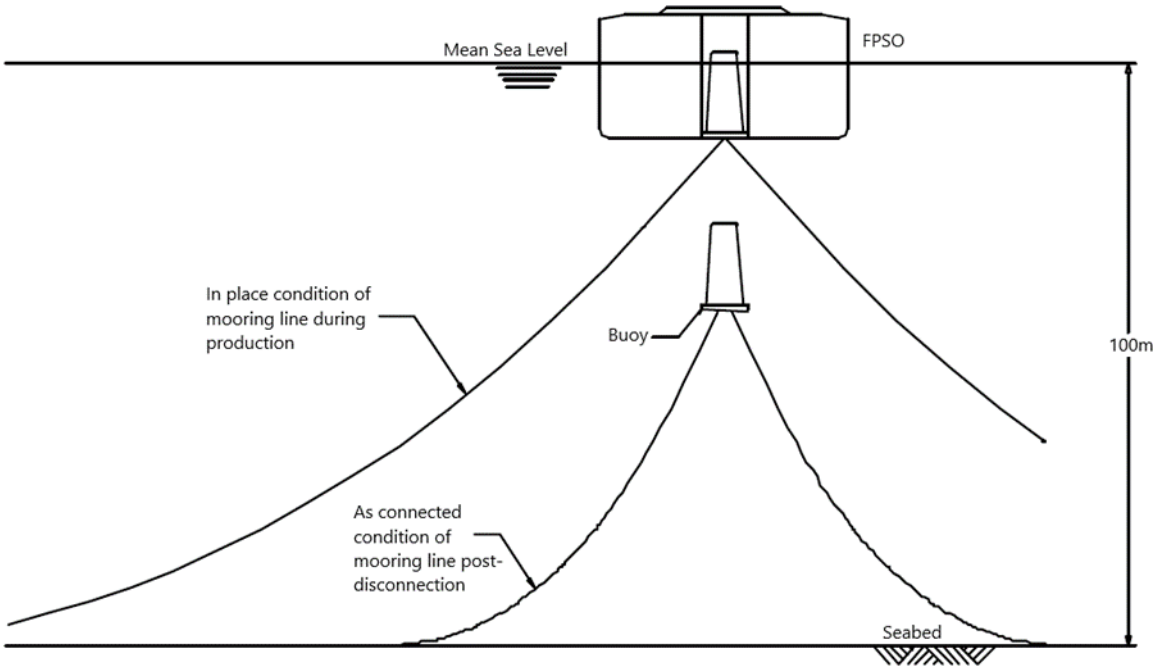

Figure 5-2: Mooring chain and buoy position during production (2002-2012) and post-disconnection (2012-2002)

Figure 5-3: DSPM anchors and chains

5.7.2 Umbilical and Flowline Crossing Mattresses and Grout Bags

Eight concrete mattresses and 16 grout bags were installed over umbilical and flowline infrastructure for stabilisation during operations. The mattresses are approximately eight feet by 20 feet by 4.5 inches in size and are constructed predominantly of concrete, with small amounts of stabilised copolymer extruded fibre rope and polyvinylchloride. Figure 5-4 shows examples of the current state of the mattresses, taken during ROV surveys.

The grout bags are plastic bulk bags made from polypropylene and are typically 0.9 m by 0.9 m by 0.9 m in size. The bulk bags are 1 Te rated and are packed with twenty 20 kg dry cement bags, typically weighing 400 kg per bag in air. Figure 5-5 shows an image of one of the grout bags, taken during ROV surveys.

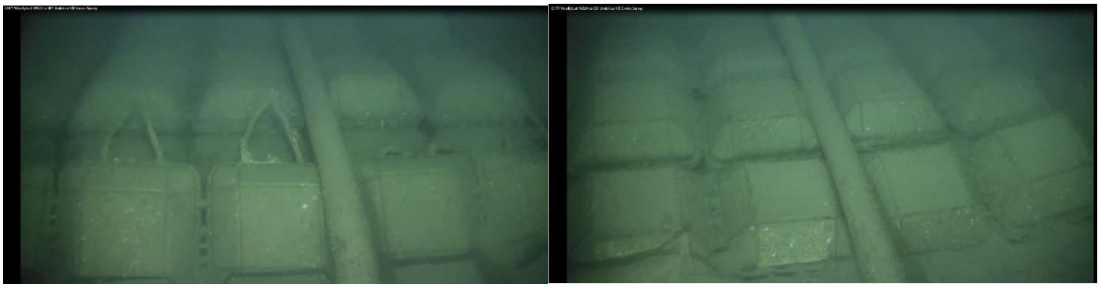

Figure 5-4: ROV image of a concrete mattress in Woollybutt field

Figure 5-5: ROV image of a grout bag in Woollybutt field

5.7.3 Umbilicals and Umbilical Jumpers

During production, the subsea control modules included control umbilicals which contained cores for hydraulic fluid, chemical injection and power and signal cores for control and data recovery from the wells' horizontal Xmas trees and downhole gauges.

The umbilical system also included umbilical baskets, subsea umbilical termination units and umbilical termination assemblies. All of these structures will be cut from the umbilicals and umbilical jumpers and removed under the Field Management EP. The discharge of fluids contained in the umbilical as a result of cutting is also covered under the Field Management EP.

Therefore, only the umbilicals and umbilical jumpers listed in Table 5-1 will remain in situ and will contain only seawater.

Table 5-1: Umbilical and umbilical jumpers to be left in situ

Description	Qty	Length (m)	Total Length (m)
EHU Jumper (SB1M to WB2A)	1	22	22
Infield EHU (SUTU to SUTU)	1	1,670	1670
Infield EHU (UTA1 to UTA2)	1	5,750	5750
EHU, FPSO to WB2/SB1 FPSO SUTU	1	1075	1075
EHU, DSPM to WBT DSPM SUTU	1	1075	1075
		Total	9592

The umbilicals and umbilical jumpers comprise carbon steel, polymers and small amounts of lead, copper and aluminium.

5.7.4 Flexible and Reinjection Flowlines and Jumpers

A number of flowlines and jumpers located at the Woollybutt field were used for transporting gas from the wells. At the end of operations, the flowlines were left with seawater treated with a multi-functional inhibitor, Hydrosure O-3670R, at a concentration of approximately 850 ppm. Residual hydrocarbon concentrations were reduced to 30 ppm in all but the flowlines between WB4 manifold and SB1 manifold and WB4 and WB4 manifold. These flowlines were reduced to an oil in water content of 200 ppm.

During activities to be performed under the Field Management EP, the flowlines will be cut and left on the seabed. It is expected that preservation fluids in the flowline will be released at the time of cutting and no further discharges are expected to occur during the Petroleum Activities Program.

Table 5-2 outlines the flowlines and jumpers that will be decommissioned in situ. Flowlines and jumpers are comprised of carbon steel, stainless steel and polymers with small amounts of alloy steel and aluminium. Figure 5-6 shows examples of the current state of the flexible and reinjection flowlines and jumpers.

Table 5-2: Flowlines and jumpers to be left in situ

Description	Length (m)	Total Length (m)
Six-inch flowlines		
6" Flexible Jumper	17	17
6" Flexible Flowline (SB1M to SB1)	1,670	1670
6" Flexible Flowline (SB1M to WB4M)	5,750	5750
6" Flexible Jumper (WB4M to WB4)	50	50
6" Flexible riser, DSPM to SB1M	1045	1045
6" Flexible riser, DSPM to WB1A	1045	1045
Four-inch gas lift lines		
4" Flexible Flowline (SB1M to WB4M)	5,750	5750
4" Flexible Jumper (WB4M to WB4)	50	50
Two-and-a-half-inch gas lift lines		
2-1/2" Flexible Flowline (SB1M to SB1)	1,670	1670
2-1/2" flexible riser, DSPM to SB1M	1035	1035
2-1/2" flexible riser, DSPM to WB1A	1035	1035

Image 2.6-01 - 2" Gas Lift - Exposed

Image 2.6-02 - 2" Gas Lift - Marine Growth

Image 2.6-03 - 2" Gas Lift - Marine growth

Image 2.6-04 - 2" Gas Lift - Free Span

Image 2.6-05 - 2" Gas Lift - Shallow Burial

Image 2.6-06 - 2" Gas Lift - Manifold Connection

Figure 5-6: Flexible and reinjection flowlines

5.8 Long Term Fate of Infrastructure

5.8.1 Infrastructure Degradation

EAL commissioned Atteris to complete a degradation assessment of the equipment that is proposed to be left in situ under the Petroleum Activities Program. This report is based on the operational history of the Woollybutt field to date and the current decommissioning status of the Woollybutt system, as well as behavioural evidence and academic studies. The study has involved engineering assessments to estimate the credible degradation mechanisms and degradation timelines. The study ultimately provides an assessment of the materials that are likely to be released during degradation and their subsequent environmental fate.

All infrastructure is expected to self-bury to a burial depth of between 60 to 90% of its diameter This is expected to take up to 30 years. During this process, the breakdown of some materials will be slowed while others will be accelerated. Burial of the infrastructure will also mean some degradation components will remain buried and others will be released to the surrounding environment. The degradation of the infrastructure can be generally categorised into degradation of plastic components and metal components.

Plastics in the infrastructure (predominantly umbilicals and flowlines) are expected to break down over 1000 to 10,000 years, depending on the exact composition of polymers, which vary between infrastructure components. Table 5-3 shows the total volume of plastics in the infrastructure that may be subject to degradation.

Table 5-3: Volume of plastics in the Woollybutt infrastructure

Infrastructure	Volume of plastics (m^3)
Flowlines	171.27
Umbilicals	36.65
Anchors and chains	0
Mattresses	0.66
Grout bags	0.023

The rate at which metals break down will depend on the level of cathodic protection on the infrastructure. Cathodic protection was installed on the flowlines and umbilicals and the other remaining infrastructure has no cathodic protection. Some of the cathodic protection has depleted with others expected to provide some level of protection until the removal of anodes under the Field Management EP. This means metals without cathodic protection or with depleted cathodic protection have already begun to corrode and others will not begin to corrode until the cathodic protection is depleted. The overall timeframe for corrosion of all metals has not been predicted; however, each component is expected to take 1200 years from the time the cathodic protection has depleted or is removed. Table 5-4 shows the total volume of metals in the infrastructure that may be subject to corrosion.

Table 5-4: Volume of metals in the Woollybutt infrastructure

Infrastructure	Volume of metals (m^3)
Flowlines	152.7
Umbilicals	16.35
Anchors and chains	197.49
Mattresses	0
Grout bags	0

The specific degradation process and timeline for each piece of infrastructure is detailed in the next subsections.

The volume of concrete present in the infrastructure is outlined in Table 5-5.

Table 5-5: Volume of concrete in the Woollybutt infrastructure

Infrastructure	Volume of metals (m^3)
Grout bags	2.33
Mattresses	9.69

Concrete degradation is expected to occur primarily from chemical damage, such as carbonation, external sulphate attack or calcium leaching, and is described in further detail in Section 5.8.1.4.

5.8.1.1 Flowlines

The flowlines consist of layers that are susceptible to metal corrosion, which include the carcass, pressure armour and tensile armour. They also consist of two layers that contain plastics: the outer sheath and the inner liner. Figure 5-7 shows these components.

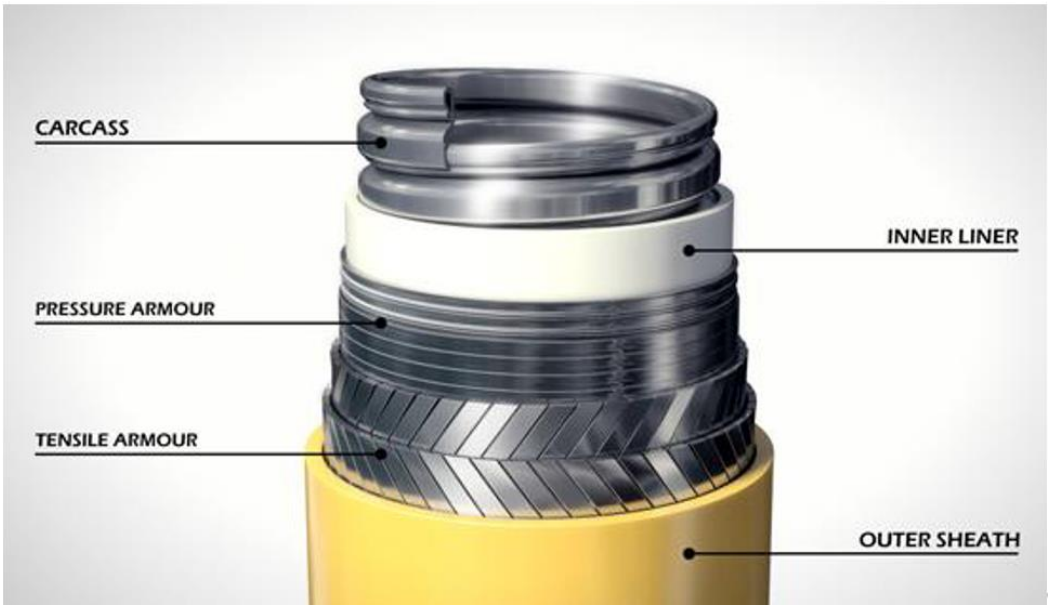

Figure 5-7: Flowline components

Based on current depletion trends, the cathodic protection system on the flowlines is expected to take up to 800 years to deplete. However, it is expected that the cathodic protection system will not provide full protection to the flowlines after the P&A and equipment removal activities (covered by a separate EP). This is because during those activities, the flowlines will be cut, and untreated seawater will enter. This will commence corrosion of the internal sections of the flowlines, which are not protected by the cathodic protection system.

It is expected that the corrosion of the carcass will occur from fresh, oxygenated seawater entering internally. This will cause pitting and corrosion at a rate of approximately 0.005 to 0.03 equivalent mm/year. On this basis it is expected to take up to 1200 years for the carcass to fully corrode (Atteris 2021).

The pressure and tensile armour are protected by the outer sheath. It is expected that the outer sheath of all flowlines will slowly degrade over a period of up to 10,000 years. As this occurs, breaches in the flowlines will occur which will allow more fresh seawater to enter and temporarily accelerate internal corrosion, including corrosion of the metal layers.

As the inner sheath becomes exposed to fresh seawater, either from corrosion of the carcass or from degradation of the outer sheath and corrosion of the tensile and pressure armour, it will slowly degrade at a similar rate to the outer sheath (1000 to 10,000 years).

Degradation and weathering of polymer-containing layers will result in buoyant polymers becoming detached and being dispersed away from the original infrastructure location. However, for the portions of the infrastructure that are buried at the time of the polymer breakdown, the polymers are more likely to stay buried.

5.8.1.2 Umbilicals

The umbilicals consist of layers that are susceptible to metal corrosion. These include the electrical cores, and the steel armour wires. They also consist of layers that contain plastics, these include the outer sheath, inner sheath, cable filler and cable outer. Figure 5-8 shows these components.

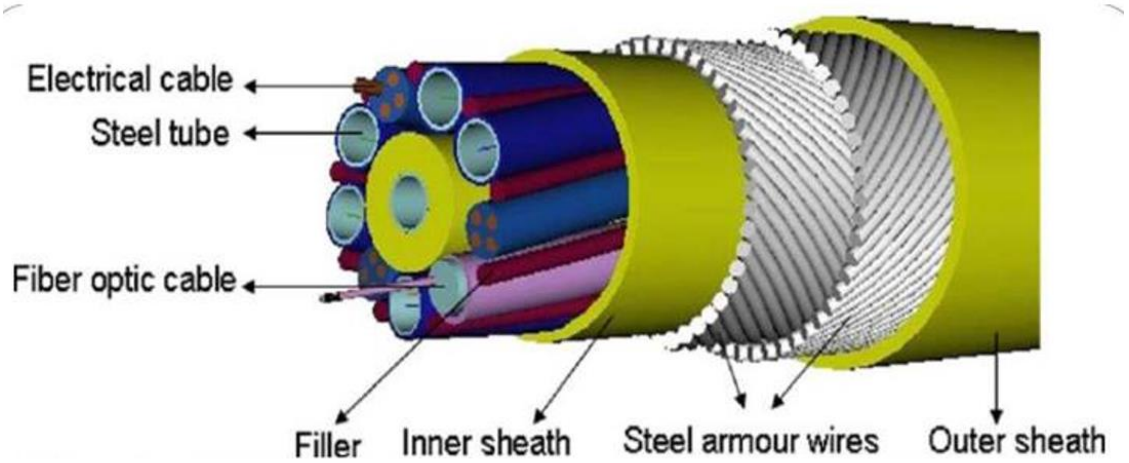

Figure 5-8: Umbilical components

The components of the umbilical comprised of polymers, the outer sheath, inner sheath, cable outer and fillers will take a significant length of time to degrade, with the upper limit expected to be 10,000 years. As the outer sheath degrades it will expose the steel armour wires.

The steel armour wires have been galvanised with zinc to protect against corrosion, which will continue to protect against corrosion until water ingress occurs as the outer sheath perforates (up to 10,000 years). The deterioration of the outer sheath is not expected to occur at the same time across the whole length of the umbilicals, so the corrosion of the steel armour wires will only happen in localised areas (a few metres) around the perforation in the outer sheath until the entire outer sheath has deteriorated.

As the armour wires corrode, they will subsequently expose the inner sheath and other umbilical internals to fresh seawater, causing them to degrade. Degradation of the inner sheath and umbilical internals will occur at similar rates to the outer sheath and steel armour wires once they are exposed to seawater.

Materials released during the corrosion and breakdown of the umbilicals will either remain in situ as the umbilicals become buried or be dispersed into the surrounding environment.

5.8.1.3 Mooring Anchors and Chains

The mooring anchors and chains consist of steel with an epoxy coating. They do not contain anodes and therefore corrosion is expected to have already commenced. The external corrosion will take three forms: pitting, microbe-induced corrosion and general corrosion. A long-term steady state corrosion rate will establish, based on the diffusion of oxygen and nutrients to the surface of the steel. It is expected that corrosion will occur at a rate of 2.1 mm/year. Based on the thickness of the chains and anchors, full corrosion could occur within 40 to 150 years.

5.8.1.4 Mattresses and Grout Bags

The mattresses and grout bags consist of concrete and plastics, with the plastic component of the mattresses mostly encapsulated within the concrete and the grout bags consisting of exposed plastic bags holding concrete material. These products are all subject to degradation.

Concrete degradation is expected to occur primarily from chemical damage, such as carbonation, external sulphate attack or calcium leaching. This causes the concrete to swell, crack and lose its strength and break down into particles that are most likely less than 10 cm by 10 cm by 10 cm in size, but which can be as small as less than 1 mm in size or as large as 50 cm or more. Any exposed pieces of concrete are likely to remain within the local area and be incorporated into the seabed, given they will have a higher density than seawater. Larger pieces are also expected to continue to break down into small particles and aggregate over time.

Plastics are expected to break down via similar mechanisms as the plastics in the flexibles and umbilicals.

6 DESCRIPTION OF THE ENVIRONMENT

This section summarises the key physical, biological, socio-economic and cultural characteristics of the Operational Area. A detailed and comprehensive description of the environment (required by OPGGS(E) Regulations 2009, Section 13(3)) is also provided in Appendix B. Copies of the DoAWE Protected Matters Search Tool outputs for the Operational Area is also available in Appendix B.

The Petroleum Activities Program does not include a credible spill scenario and therefore no zone of potential impact has been described in this EP. The only area where impacts are expected is the Operational Area and therefore only the environmental characteristics of the Operational Area have been included in this section.

6.1 Bioregion

The Operational Area lies on the continental shelf within the North-West marine region, which covers the Commonwealth Marine Area extending from the Western Australian-Northern Territory border to Kalbarri, south of Shark Bay in Western Australia (Figure 6-1). The North West Commonwealth Marine Area covers approximately 1.07 million square kilometres, is characterised by tropical and sub-tropical marine areas and includes shallow waters on the continental shelf at the state water's boundary, 3 nautical miles (NM) (5.5 kilometres) from shore, to deep ocean habitat 200 NM (370 kilometres) from shore (Commonwealth of Australia, 2012).

The major physical features of the region include:

- Highly diverse coral reefs including Ashmore, Hibernia, Scott, Seringapatam, Ningaloo and the Rowley Shoals, all of which sustain species of both conservation and commercial importance
- Coralline algal reefs carbonate pinnacles and shoals in the region's far north
- Vast areas of continental shelf and slope, plateaux and terraces, including the Exmouth and Scott plateaux, the North West and Sahul shelfs, the Wallaby Saddle and Rowley Terrace
- Australia's narrowest continental shelf, which occurs close to North West Cape, at just 7 kilometres in width
- The Indonesian Throughflow, a low-salinity water mass that acts as a major element of the global transfer of heat and water between oceans and plays a key role in initiating the Leeuwin Current
- The Joseph Bonaparte Gulf, a basin with a soft sediment floor, which is home to a low coverage of mobile invertebrates and sessile filter-feeding organisms
- Major canyons on the continental slope that facilitate sediment and nutrient transport, including Cape Range, Cloates, Carnarvon and Swan canyons
- Two areas of abyssal plain (Cuvier and Argo) with depths greater than 5000 metres.

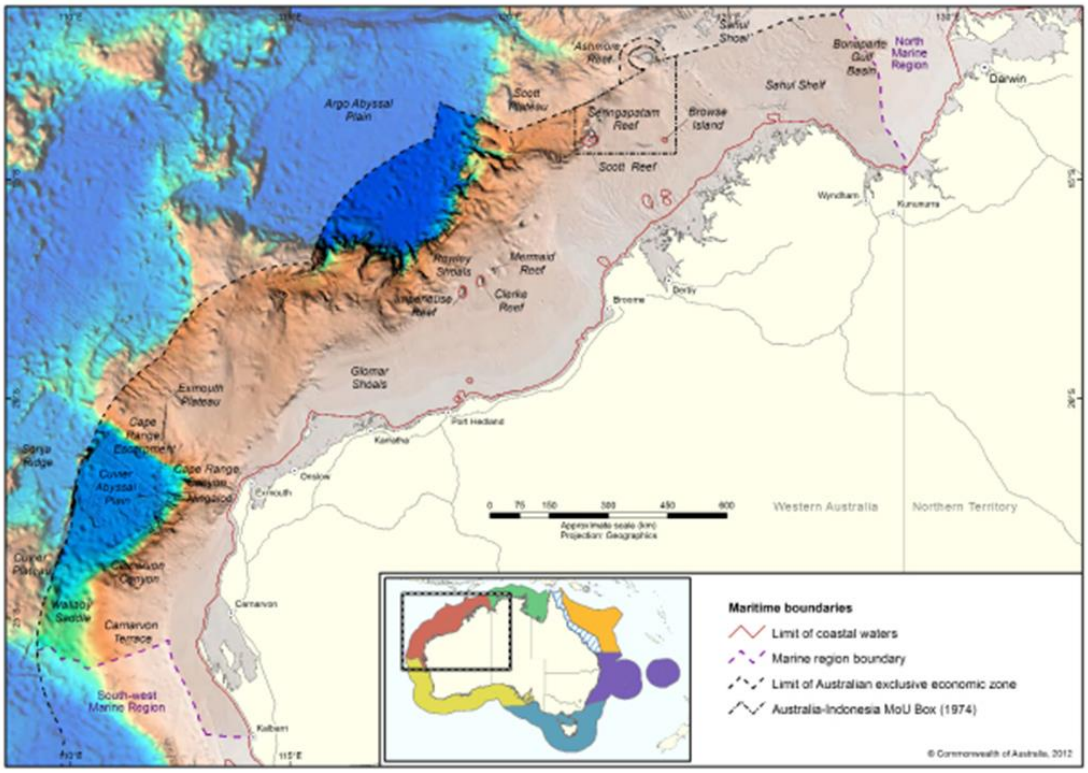

Figure 6-1: North-West marine region (Commonwealth of Australia, 2012)

The majority of the North-West marine region has low productivity, with monsoonal seasonality driving boom and bust cycles for a number of species. These monsoonal climate patterns include highly variable tidal regimes and a cyclone season that falls between December and March. However, notable locations have higher productivity (Commonwealth of Australia, 2012). These are:

- Ningaloo Reef and the associated Cloates and Cape Range canyons
- Carnarvon Canyon in the south of the region and other canyon systems
- Coral reefs along the shelf edge, including Ashmore, Scott, Seringapatam and the Rowley Shoals
- The carbonate banks and pinnacles of the Sahul Shelf.

The North-West marine region is relatively shallow, with more than 40% of the region being less than 200 metres deep. Therefore, surface currents have a strong influence. Another major factor driving ecological processes in the region is the strong seasonality of rainfall and wind direction (Commonwealth of Australia, 2012). The weakening of the Indonesian Throughflow and Leeuwin Current in the dry season (April to September and particularly during El Niño years), paired with the seasonal reversal in wind, boosts productivity through increased mixing of surface waters and deeper, nutrient-rich waters (Commonwealth of Australia, 2012).

6.2 Threatened and Migratory Species and Ecological Communities

Searches for protected species listed under the EPBC Act were undertaken on 4 and 5 July 2021 using areas that covered the full extent of the Operational Area. The

threatened/migratory species identified using the EPBC Act Protected Matters Search Tool (PMST) are listed in Table 6-1. The EPBC Act Protected Matters reports for the Operational Area are provided in Appendix B, Section 1.6.

The PMST search identified 18 species listed as 'threatened' and 33 species listed as 'migratory' within the Operational Area. Listed marine species that may occur within the Operational Area are shown in Table 6-1, with further detail provided in Appendix B. Note that terrestrial species (such as terrestrial mammals, reptiles and bird species) that appear in the PMST results have been excluded from Table 6-1. There are no listed threatened ecological communities within the Operational Area.

Table 6-1: EPBC Act listed species within the Operational Area (DoAWE, 2021)

Species	Common Name	Status	Presence in Operational Area
Birds			
Calidris canutus	Red Knot, Knot	Endangered/ Migratory	Species or species habitat may occur within area
Calidris ferruginea	Curlew Sandpiper	Critically Endangered/ Migratory	Species or species habitat may occur within area
Macronectes giganteus	Southern Giant-Petrel, Southern Giant Petrel	Endangered/ Migratory	Species or species habitat may occur within area
Numenius madagascariensis	Eastern Curlew, Far Eastern Curlew	Critically Endangered/ Migratory	Species or species habitat may occur within area
Sternula nereis	Australian Fairy Tern	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Anous stolidus	Common Noddy	Migratory	Species or species habitat may occur within area
Calonectris leucomelas	Streaked Shearwater	Migratory	Species or species habitat likely to occur within area
Fregata ariel	Lesser Frigatebird, Least Frigatebird	Migratory	Species or species habitat likely to occur within area
Actitis hypoleucos	Common Sandpiper	Migratory	Species or species habitat may occur within area
Calidris acuminata	Sharp-tailed Sandpiper	Migratory	Species or species habitat may occur within area
Calidris melanotos	Pectoral Sandpiper	Migratory	Species or species habitat may occur within area
Pandion haliaetus	Osprey	Migratory	Species or species habitat may occur within area
Fish, Sharks and Rays			
Anoxypristis cuspidata	Narrow Sawfish, Knifetooth Sawfish	Migratory	Species or species habitat may occur within area

Species	Common Name	Status	Presence in Operational Area
Manta alfredi	Reef Manta Ray, Coastal Manta Ray, Inshore Manta Ray, Prince Alfred's Ray, Resident Manta Ray	Migratory	Species or species habitat may occur within area
Manta birostris	Giant Manta Ray, Chevron Manta Ray, Pacific Manta Ray, Pelagic Manta Ray, Oceanic Manta Ray	Migratory	Species or species habitat likely to occur within area
Carcharias taurus (west coast population)	Grey Nurse Shark (west coast population)	Vulnerable	Species or species habitat may occur within area
Carcharodon carcharias	White Shark, Great White Shark	Vulnerable/ Migratory	Species or species habitat may occur within area
Carcharodon longimanus	Oceanic Whitetip Shark	Migratory	Species or species habitat likely to occur within area
Pristis zijsron	Green Sawfish, Dindagubba, Narrowsnout Sawfish	Vulnerable/ Migratory	Species or species habitat known to occur in area
Rhincodon typus	Whale Shark	Vulnerable/ Migratory	Foraging, feeding or related behaviour likely to occur within area Overlap with foraging BIA
Isurus oxyrinchus	Shortfin Mako, Mako Shark	Migratory	Species or species habitat likely to occur in area
Isurus paucus	Longfin Mako	Migratory	Species or species habitat likely to occur in area
Marine Mammals			
Balaenoptera borealis	Sei Whale	Vulnerable/Migratory	Species or species habitat likely to occur within area
Balaenoptera musculus	Blue Whale	Endangered/ Migratory	Species or species habitat likely to occur within area
Balaenoptera physalus	Fin Whale	Vulnerable/Migratory	Species or species habitat likely to occur within area
Megaptera novaeangliae	Humpback Whale	Vulnerable/Migratory	Species or species habitat known to occur within area Overlap with migration BIA
Balaenoptera edeni	Bryde's Whale	Migratory	Species or species habitat may occur within area
Orcinus orca	Killer Whale, Orca	Migratory	Species or species habitat may occur within area
Physeter macrocephalus	Sperm Whale	Migratory	Species or species habitat may occur within area

Species	Common Name	Status	Presence in Operational Area
Tursiops aduncus (Arafura/Timor Sea populations)	Spotted Bottlenose Dolphin (Arafura/Timor Sea populations)	Migratory	Species or species habitat may occur within area
Reptiles			
Caretta caretta	Loggerhead Turtle	Endangered/ Migratory	Species or species habitat known to occur within area
Chelonia mydas	Green Turtle	Vulnerable/Migratory	Species or species habitat known to occur within area
Dermochelys coriacea	Leatherback Turtle, Leathery Turtle, Luth	Endangered/ Migratory	Species or species habitat likely to occur within area
Eretmochelys imbricata	Hawksbill Turtle	Vulnerable/Migratory	Species or species habitat known to occur within area
Natator depressus	Flatback Turtle	Vulnerable/Migratory	Congregation or aggregation known to occur within area Overlap with internesting buffer BIA

Each of the species are listed in Table 6-1 and discussed below on the basis they may occur in the Operational Area at various times of the year, generally as transient visitors to the area during migration and feeding. No known breeding grounds or sensitive habitat critical to the species outlined in Table 6-1 are known to occur within the Operational Area.

A number of other marine species that are protected under the EPBC Act and relevant international agreements but are not listed as Matters of National Environmental Significance under the EPBC Act are also described below. A list of these species is provided in Table 6-2.

Table 6-2 descriptions of threatened marine species and their presence relative to the Operational Area are presented in Appendix B.

Table 6-2: Conservation advice for EPBC Act listed threatened species within the Operational Area (DoEE, 2017)

Common Name	Conservation Advice/ Recovery Plan	Relevant Threats Identified	Relevant Management Advice/ Conservation Actions
Marine Mammals			
Sei whale	Approved Conservation Advice for *Balaenoptera borealis* (sei whale) (TSSC, 2015)	None relevant to the Petroleum Activities Program	None applicable
Blue whale	Conservation Management Plan for the Blue Whale – A Recovery Plan under the *EPBCAct 1999* (Commonwealth of Australia, 2015)	None relevant to the Petroleum Activities Program	None applicable
Fin whale	Approved Conservation Advice for *Balaenoptera physalus* (fin whale) (TSSC, 2015)	None relevant to the Petroleum Activities Program	None applicable
Humpback whale	Approved Conservation Advice for *Megaptera novaeangliae* (humpback whale) (TSSC, 2015)	None relevant to the Petroleum Activities Program	None applicable
Marine Reptiles			
Loggerhead turtle	Recovery plan for marine turtles in Australia (DoEE, 2017)	Marine debris	• Reduce impacts from marine debris. Section 9.3 assesses the potential for the petroleum activities to contribute to marine debris.
Green turtle			
Hawksbill turtle			
Flatback turtle			
Leatherback turtle, leathery turtle, luth	Commonwealth Conservation Advice on *Dermochelys coriacea* (TSSC, 2008)	Marine debris	• Reduce impacts from marine debris. Section 9.3 assesses the potential for the petroleum activities to contribute to marine debris.
	Recovery plan for marine turtles in Australia (DoEE, 2017)	Marine debris	• Reduce impacts from marine debris. Section 9.3 assesses the potential for the petroleum activities to contribute to marine debris.

6.2.1 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 (DoEE, 2017). BIAs have been identified using expert scientific knowledge about species abundance, distribution and behaviours (DoEE, 2017).

BIAs for the following species have been identified within the Operational Area:

- Wedge tailed shearwater – breeding and foraging (Figure 6-2: BIAs for bird species)
- Whale shark – foraging including high density prey (Figure 6-3)
- Pygmy blue whale – distribution (Figure 6-4)
- Humpback whale – migration (Figure 6-4)
- Flatback turtle – internesting buffer (Figure 6-5).

Where these BIAs apply to threatened and/or migratory species, they are discussed in further detail in the relevant subsections below.

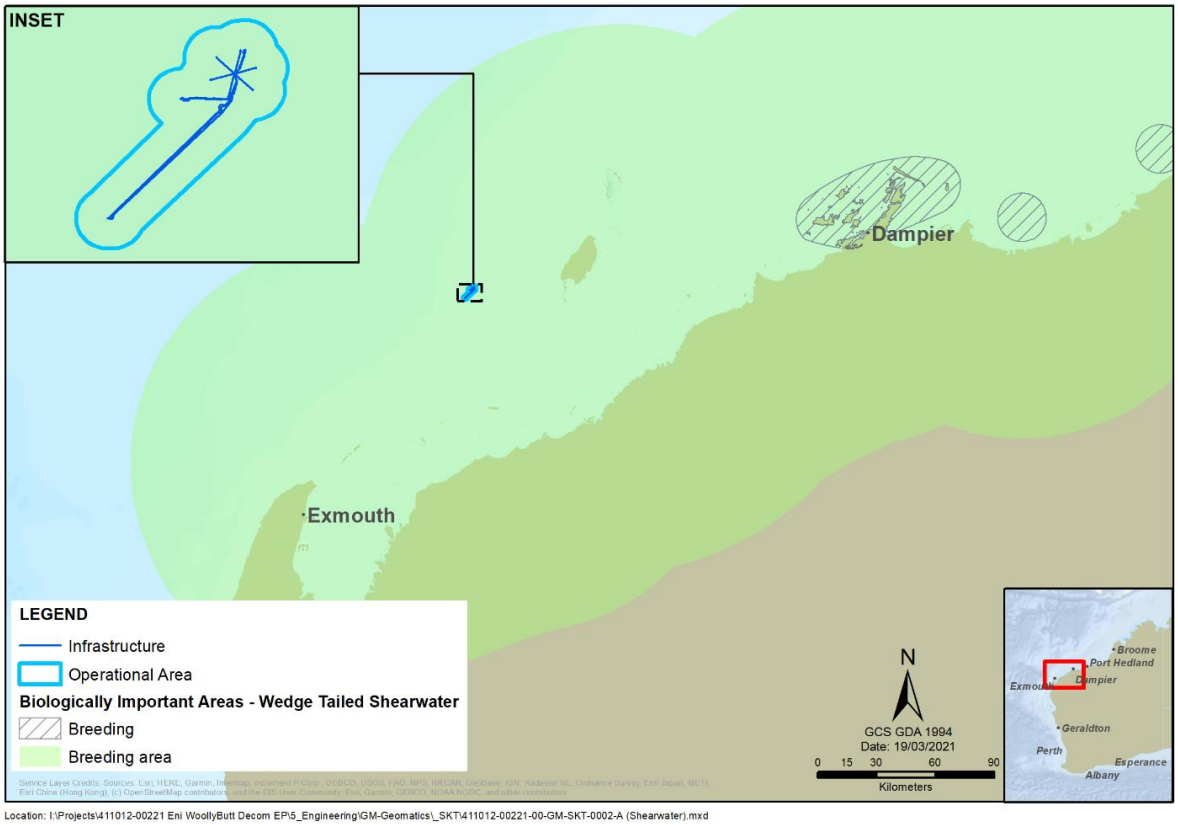

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Figure 6-2: BIAs for wedged tailed shearwater

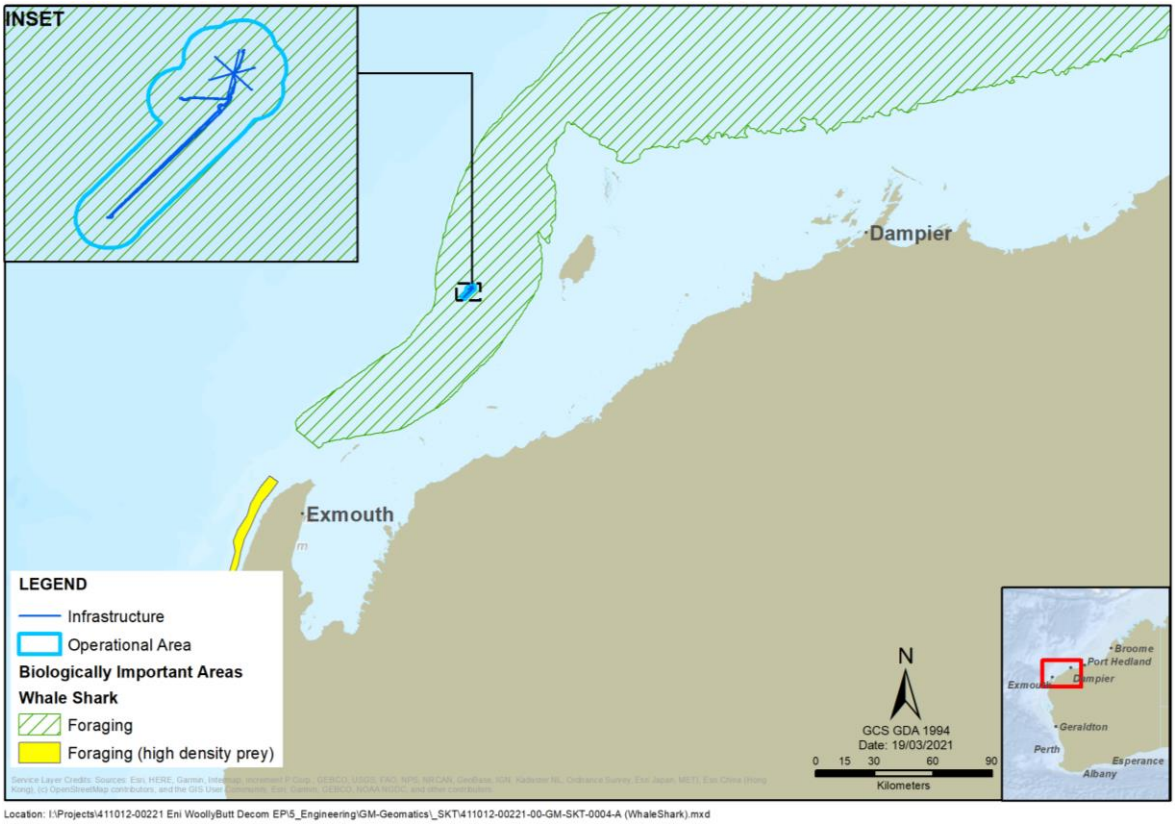

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Figure 6-3: BIAs for whale shark

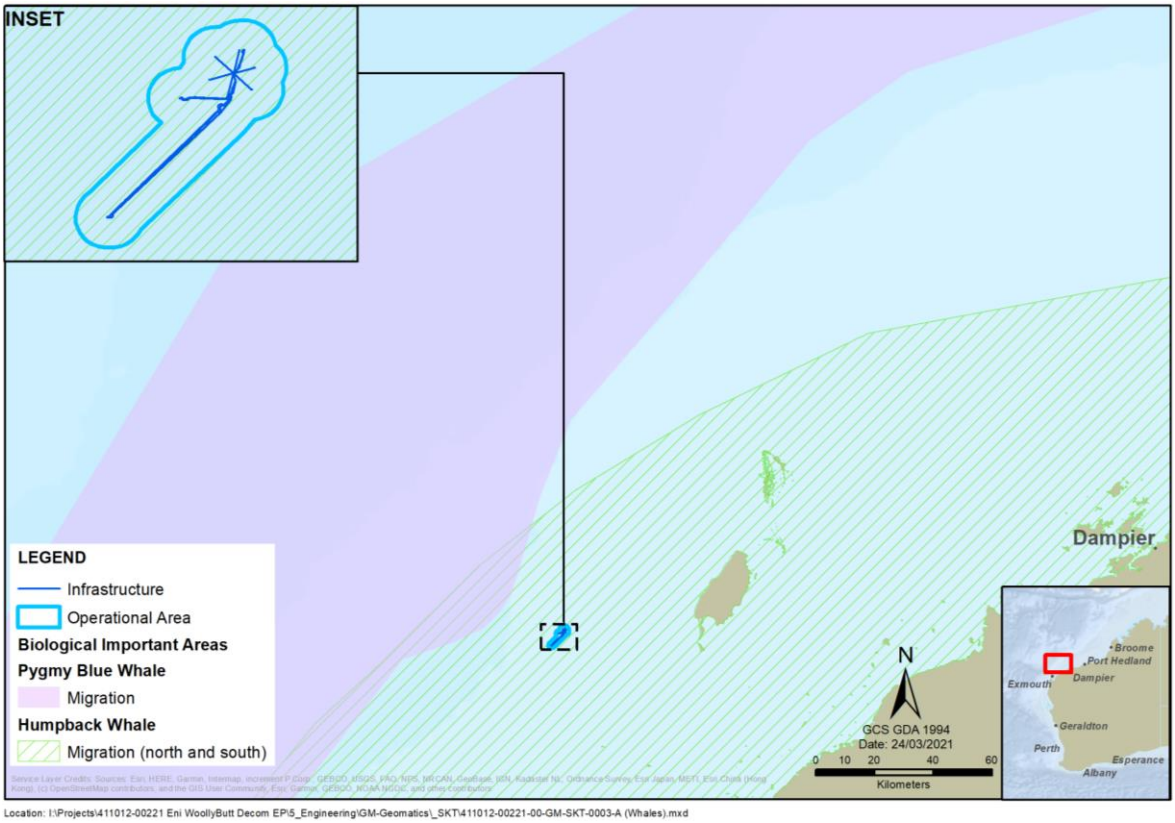

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Figure 6-4: BIAs for cetaceans

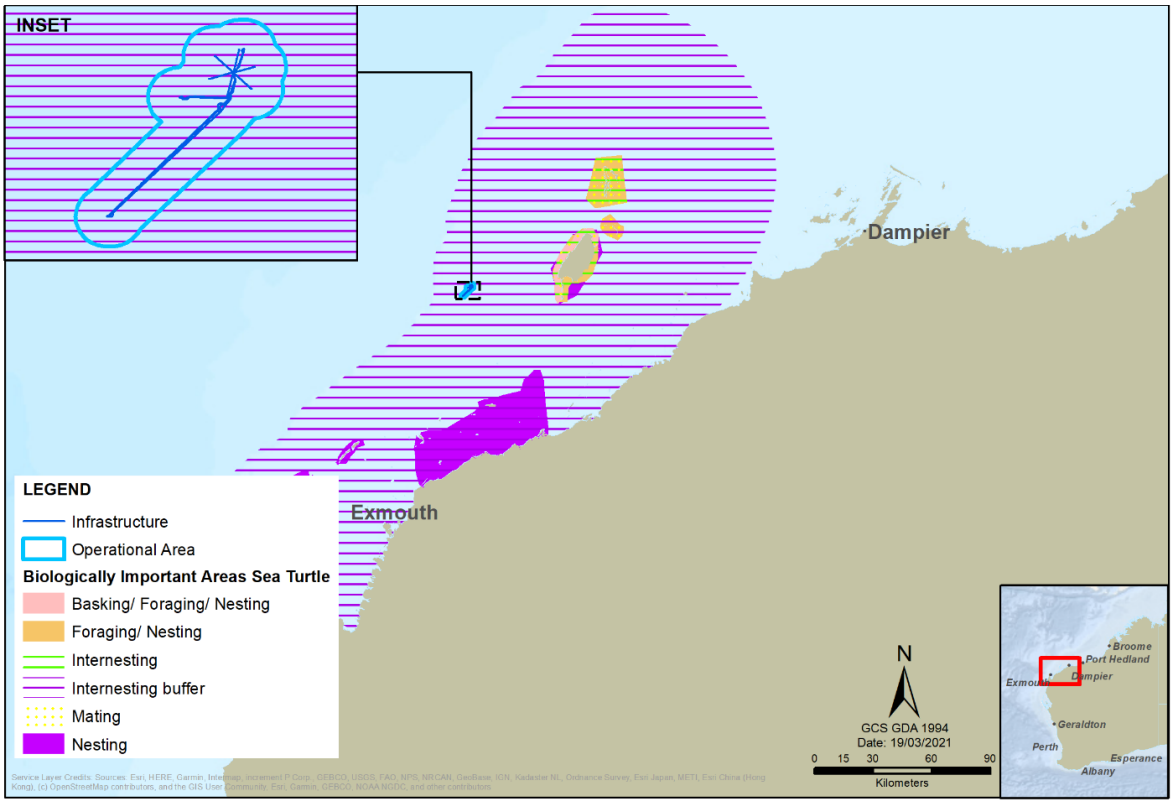

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Figure 6-5: BIAs for Flatback turtle

6.3 Cultural and Socio-Economic Environment

6.3.1 Commercial Fisheries

Commercial fisheries that operate in the waters of the NWS are centred in Onslow, 65 km to the south of the field; Exmouth, 120 km to the southwest; and Dampier, approximately 180 km to the east. The focus of commercial fishing activity is mainly the inner continental shelf and waters surrounding the offshore islands to depths of about 30 m. Commonwealth- and State-managed fisheries that overlap the Operational Area are summarised below.

6.3.1.1 Commonwealth Fisheries

Commonwealth fisheries within the Operational Area are listed in Table 6-3. The locations of these fisheries in relation to the Operational are shown in Figure 6-6.

Table 6-3: Commonwealth fisheries within the Operational Area

Fishery	Presence in OA[1,2]
Western Tuna and Billfish Fishery	Rare
Southern Bluefin Tuna Fishery	Rare
Western Skipjack Fishery	Rare

[1] OA = Operational Area

[2] Likelihood of presence evaluated in line with EAL Risk Matrix

Further details and descriptions of Commonwealth fisheries within the Operational Area are presented in Appendix B.

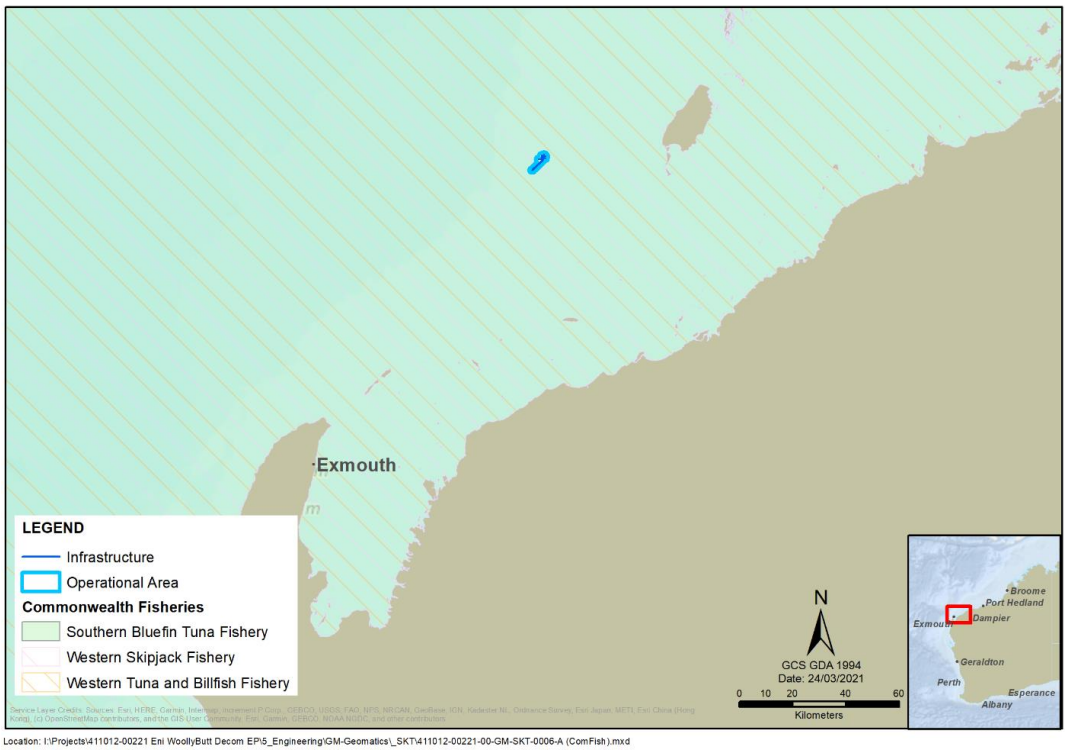

Figure 6-6: Commonwealth fisheries within the Operational Area

6.3.1.2 State Fisheries

State-managed fisheries within the Operational Area are listed in Table 6-4. The locations of these fisheries in relation to the Operational Area are shown in Figure 6-7.

Table 6-4: State fisheries within the Operational Area

Fishery	Licensed to fish in operational area	Potential for interaction	Description
State Managed Fisheries			
Mackerel Managed Fishery	✓	✓	**Description:** The Mackerel Managed Fishery (MMF) targets Spanish mackerel (*Scomberomorus commerson*) using near-surface trawling gear from small vessels in coastal areas around reefs, shoals and headlands. Jig fishing is also used to capture grey mackerel (*S. semifasciatus*), with other species from the genera Scomberomorus (Lewis *et al.*, 2020). The commercial fishery extends from Cape Leeuwin to the Northern Territory border. There are three managed fishing areas: Kimberley (Area 1), Pilbara (Area 2), and Gascoyne and West Coast (Area 3). The operational area is located within Area 3. The majority of the catch is taken from waters off the Kimberley coasts (Lewis and Jones, 2018), reflecting the tropical distribution of mackerel species (Molony *et al.*, 2015). The majority of fishing activity occurs around the coastal reefs of the Dampier Archipelago and Port Hedland area, with the seasonal appearance of mackerel in shallower coastal waters most likely associated with feeding and gonad development prior to spawning (Mackie *et al*. 2003). Spanish mackerel spawn between August and November when inhabiting coastal reef areas of the Exmouth/Gascoyne region, with females exhibiting serial spawning behaviour (spawning every one to three days) over the spawning period. Outside the main fishing season (December to April), it is unclear where the mackerel populations inhabit. However, there is anecdotal evidence to suggest populations move into deeper offshore waters (Mackie *et al.*, 2003). Records show that no vessels were active in the 60 NM block that covers the operational area between 2018 and 2020. **Licences/vessels:** 15 boats fished in the MMF during 2019 (Lewis et al. 2020)

Fishery	Licensed to fish in operational area	Potential for interaction	Description
Pilbara Demersal Scalefish Fishery – Line	✓	✓	**Description:** The Pilbara Line Fishery (PLF) 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 (Newman *et al.*, 2014). The PLF targets tropical demersal scalefish and is the smallest scale fishery within the Pilbara Demersal Scale Fishery (PDSF) in terms of monetary value, attaining a commercial catch of 40 t (Newman *et al.,* 2015b). There are no stated depth limits and the western extent of the fishery is the boundary of the AFZ (Newman *et al.*, 2015b). The PLF is managed under the Prohibition on Fishing by Line from Fishing Boats (Pilbara Waters) Order 2006 with the exemption of nine fishing vessels for any nominated five-month block period within the year. Fishing in Area 3 has also been a closed to line fishing since 1998 (Newman *et al.*, 2015b). Records show that a maximum of four vessels were active in the 60 NM block that covers the operational area between 2018 and 2020. **Licences/vessels:** five vessels were active in the trap fishery during 2019 (Newman et al, 2020a).
Pilbara Demersal Scalefish Fishery – Trap	✓	✓	**Description:** The Pilbara Trap Fishery covers the area from Exmouth northwards and eastwards to the 120° line of longitude, and offshore as far as the 200 m isobath. Like the trawl fishery, the trap fishery is also managed by the use of input controls in the form of individual transferable effort allocations monitored with a satellite-based vessel monitoring system. Waters inside of the 50 m isobath are permanently closed to trap fishing and Area 3 has also been closed to trapping since 1998 (Newman *et al.*, 2015b). Traps are limited in number with the greatest effort in waters greater than 50 m depth. This fishery targets high value species such as red emperor and goldband snapper (Newman et al, 2020a). Records show that less than three vessels were active in the 60 NM block that covers the operational area between 2018 and 2020. **Licences/vessels:** three vessels were active in the trap fishery during 2019 (Newman et al, 2020a).
Pilbara Demersal Scalefish Fishery – Trawl	×	×	**Description:** The Pilbara Trawl Fishery is divided into two zones and waters inside of the 50 m isobath are permanently closed to fish trawling. The operational area is located within Zone 1, which has been closed to fish trawling since 1998 (Gaughan *et al*., 2019). Only if this fishery was to reopen would there be any potential for interaction. The Pilbara Trawl Fishery operates with standard stern trawling gear (single net with extension sweeps). Records show that there two vessels were active in the operational trawl sector (zone 2) of the PDSF in 2019. (Newman et al, 2020a).

Fishery	Licensed to fish in operational area	Potential for interaction	Description
Marine Aquarium Managed Fishery	✓	×	**Description:** The Marine Aquarium Managed Fishery operates within Western Australian waters, between the Northern Territory and South Australia borders. The operational area is located within the managed fishery. The fishery is primarily a dive-based with fishers using hand-held nets to capture the desired target species and is restricted to safe diving depths (typically < 30 m). The fishery is typically active more active in waters south of Broome with higher levels of effort around the Capes region, Perth, Geraldton, Exmouth, Dampier and Broome. The landed catch was predominantly ornamental fish but also included hermit crabs, seahorses, invertebrates, corals and live rock (Newman *et al.*, 2014). Records show that no vessels were active in the 60 NM block that covers the operational area between 2018 and 2020. **Licences/vessels:** there were 12 licences in 2019, ten of which were active (Newman et al. 2020b).
Pilbara Crab Managed Fishery	✓	×	**Description:** The Pilbara Crab Managed Fishery primarily targets blue swimmer crabs using hourglass traps, primarily within inshore waters around Nichol Bay and the Exmouth Gulf. The blue swimmer crab is most abundant sandy benthic habitats with water depths of less than 20 metres (Johnston et al. 2020a). Catch rates for the fishery in 2019 saw a significant increase (88%) from 2018. This catch rate was well above the preliminary harvest strategy threshold, indicating there should be adequate egg production under typical environmental conditions (Johnston et al. 2020b). Records show that no vessels were active in the 60 NM block that covers the operational area between 2018 and 2020. **Licences/vessels:** Two people were employed as skippers and crew on vessels operating in the Pilbara Crab Managed Fishery in 2019 (Johnston et al. 2020b).
Specimen Shell Managed Fishery	✓	×	**Description:** The Specimen Shell Managed Fishery can be conducted anywhere within Western Australia waters and targets the collection of specimen shells for display, collection, cataloguing and sale. The Specimen Shell Managed Fishery encompasses the entire WA coastline but effort is concentrated in areas adjacent to the largest population centres such as: Broome, Exmouth, Shark Bay, Geraldton, Perth, Mandurah, the Capes area and Albany (Hart et al. 2020). Collection is predominately by hand when diving or wading in shallow, coastal waters though a deeper water collection aspect to the fishery has been initiated with the employment of ROVs operating at depths up to 300 m (Hart et al., 2020). A number of areas are closed to the Specimen Shell Managed Fishery, including various marine parks and aquatic reserves such as Reef Observation Areas and Fish Habitat Protection Areas (Hart et al., 2020). Records show that no vessels were active in the 60 NM block that covers the operational area between 2018 and 2020. **Licences/vessels:** 31 licences in 2019/20 (each licence allows a maximum of four divers in the water at any one time), 17 were utilised for fishing in 2019 (Hart et al., 2020).

Fishery	Licensed to fish in operational area	Potential for interaction	Description
South-west Coast Salmon Fishery	✓	×	**Description: Description:** The South West Coast Salmon Managed Fishery is one of 10 commercial fisheries that make up the West Coast Nearshore and Estuarine Finfish Resource The main commercial methods are haul, beach seine and gill netting (Duffy and Blay, 2020). In 2019, the South West Coast Salmon Managed Fishery was a major contributor to the total commercial catch for the West Coast Nearshore and Estuarine Finfish Resource with two fish species (Western Australian salmon and sea mullet) making up the majority of the catch. Records show that no vessels were active in the 60 NM block that covers the operational area between 2018 and 2020. **Licences/vessels:** N/A
Onslow Prawn Managed Fishery	✓	×	**Description**: The Onslow Prawn Managed Fishery encompasses a portion of the continental shelf off the Pilbara. The fishery targets a range of penaeids including king prawns (*Penaeus latisulcatus*), brown tiger prawns (*Penaeus esculentus*) and blue endeavour prawns (*Metapenaeus endeavouri*), which typically inhabit soft sediments < 45 m water depth. Fishing is carried out using trawl gear over unconsolidated sediments (sand and mud). Total prawn catches in 2019 were less than 50 tonnes, below the target catch range (Kangas *et al.*, 2020). Records show that no vessels were active in the 60 NM block that covers the operational area between 2018 and 2020. **Licences/vessels**: One vessel fished in the Onslow Prawn Managed Fishery during 2019 (Kangas *et al.* 2020).
West Australian Abalone Fishery	✓	×	**Description**: The Western Australian abalone fishery includes all coastal waters from the Western Australian and South Australian border to the Western Australian and Northern Territory border. The fishery is concentrated on the south coast (greenlip and brownlip abalone) and the west coast (Roe's abalone). Abalone are harvested by divers, limiting the fishery to shallow waters (typically < 30 m). No commercial fishing for abalone north of Moore River (Zone 8 of the managed fishery) has taken place since 2011–2012. A restocking project has been successful in a trial scale but has yet to be implemented on a commercial scale to determine if restocking would recover the entire stock in the longer term. (Strain et al., 2020); interactions with participants in the fishery will not occur during the Petroleum Activities Program. Records show that no vessels were active in the 60 NM block that covers the operational area between 2018 and 2020. **Licences/vessels:** 21 vessels were active in Roe's abalone fishery (Strain et al., 2020).

Fishery	Licensed to fish in operational area	Potential for interaction	Description
West Coast Deep Sea Crustacean	✓	×	**Description:** The West Coast Deep Sea Crustacean fishery is a 'pot' fishery that operates in a long-line formation in the shelf edge waters (> 150 m) of the West Coast and Gascoyne bioregions (How and Orme, 2020). The fishery targets three crab species; Crystal (snow) (*Chaceon albus*), Champagne (*Hypothalassia acerba*) and Giant (king) (*Pseudocarcinus gigas*). Crystal crab makes up the vast majority (99% in 2019) of annual total landings. Records show that no vessels were active in the 60 NM block that covers the operational area between 2018 and 2020. **Licences/vessels**: Four vessels operated in the fishery in 2019 (How and Orme, 2020).

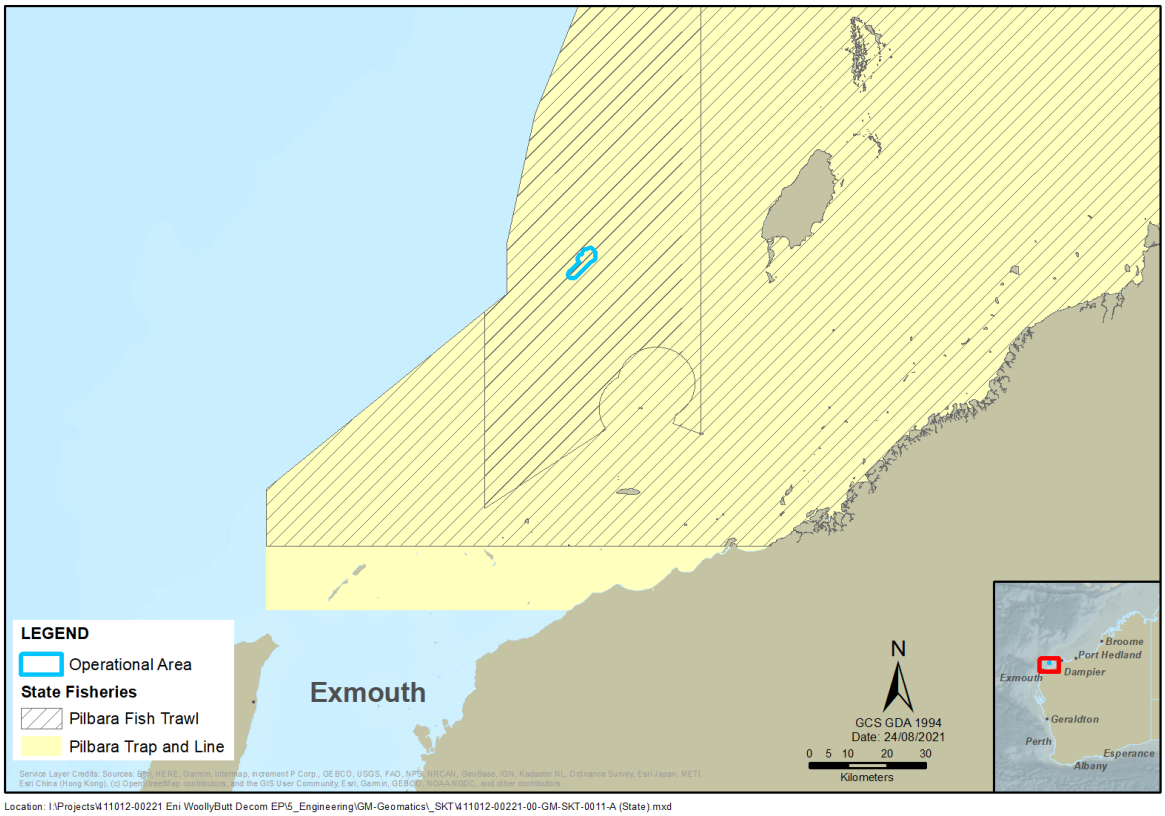

Figure 6-7:Pilbara Trawl, Line and Trap Fisheries within the Operational Area

6.3.2 Tourism and Recreational Fishing

There are no tourism operations within the Operational Area.

Recreational fishing mainly occurs near coastal islands including Thevenard Island located approximately 40 km south of the Operational Area. No recreational fishing is known to occur in the deep waters of the Operational Area.

6.3.3 Commercial Shipping

Most shipping that occurs within and near the Operational Area is associated with the oil and gas industry, the field being located inshore of major shipping lanes between Australia and Asia. The closest major ports to the field are Dampier and Port Hedland to the north-east of the field. Figure 6-8 shows historical automatic identification system (AIS) traffic plots, with data collected up until January 2021. Vessel point density analysis conducted by AMSA indicates the Operational Area is located outside of local shipping lanes of the NWS, and vessel density in the vicinity of the field is low (i.e., less than or equal to five vessel reports per km²). It is possible transient shipping traffic may occur albeit in low volumes.

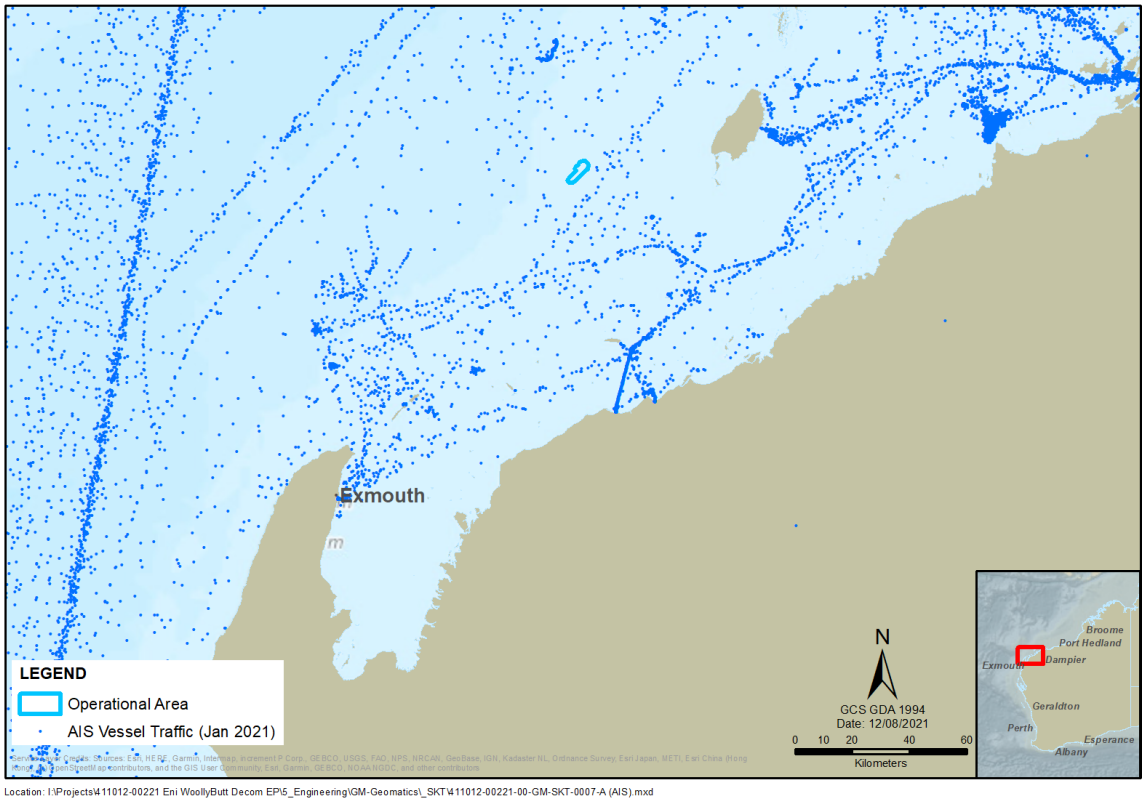

Figure 6-8: Map showing the Woollybutt oil field with AIS data (January 2021)

6.3.4 Defence Activities

The Operational Area is located within Sectors R852A and R852B of the North West Australia Exercise Area, a Defence Practice Area. Each of these is declared as a military flying training area activated by Notice to Airmen, existing in height blocks from 10,000 ft to 28,000 ft and 28,000 ft to 60,000 ft, respectively (Figure 6-9).

There are nearby ordnance sea dumping locations, at the reported position of 21° 23' 00" S, 114° 37' 00" E, where 'cartridges' were dumped in 183 m of water in 1969, and the disposal of unrecorded quantities of unexploded depth charges at 20° 23' 02" S, 115° 39' 57" E and 21° 29' 00" S, 114° 39' 42" E (Plunkett, 2003). The nearest of these reported locations from the Woollybutt field is the site where cartridges

were dumped, which is about 34 NM (61 km) from the nominated Woollybutt disposal datum. Of the two depth charge disposal sites, the latter is the closest to the Woollybutt field, at a distance of around 38 NM (68 km) from the Woollybutt field.

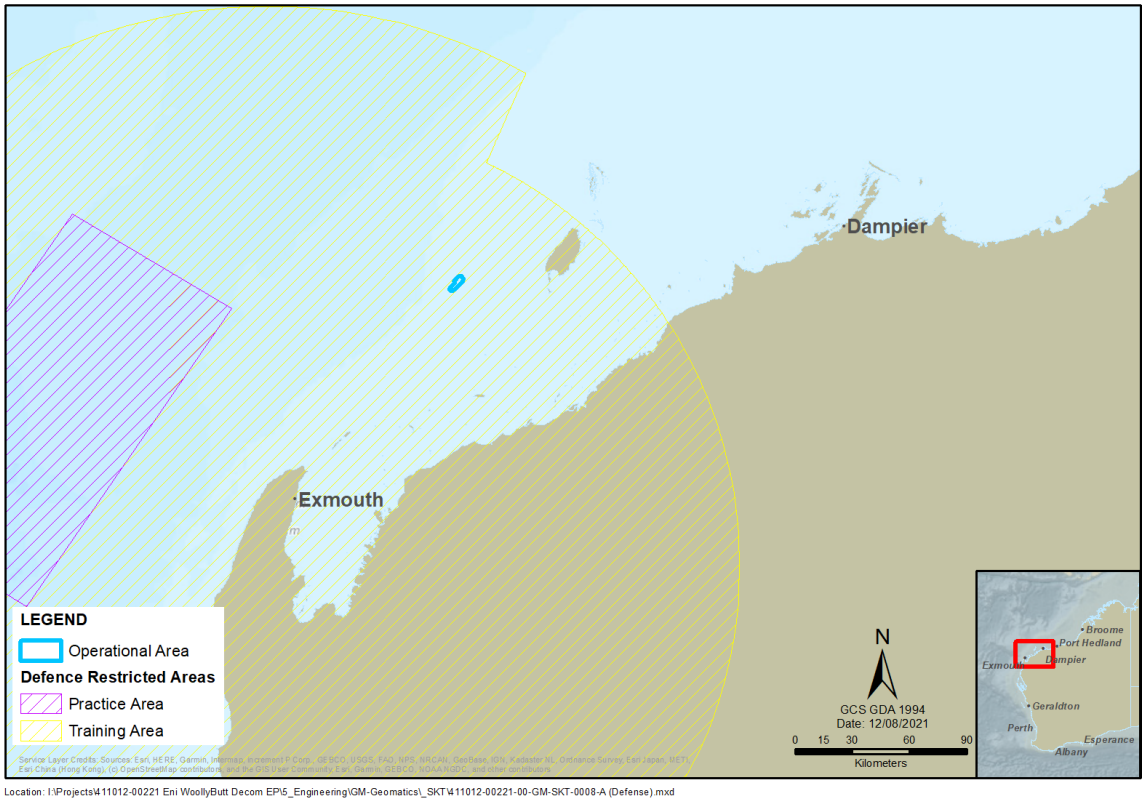

Figure 6-9: Defence-restricted areas

6.3.5 Oil and Gas Activities

The NWS is a well-developed petroleum region, supporting a large number of operating oil and gas fields, along with a number of proposed developments under construction and exploration and appraisal of prospective areas.

The Operational Area is located approximately 40 km west of Barrow Island, where Chevron Australia has been producing oil since 1967. The Operational Area is also located approximately 45 km south of the Gorgon gas fields, and approximately 35 km south-east of the nearest exploration well, Zola-1, which was completed in 2011. The Chevron-operated Wheatstone pipeline runs along the western side of the Woollybutt permit area.

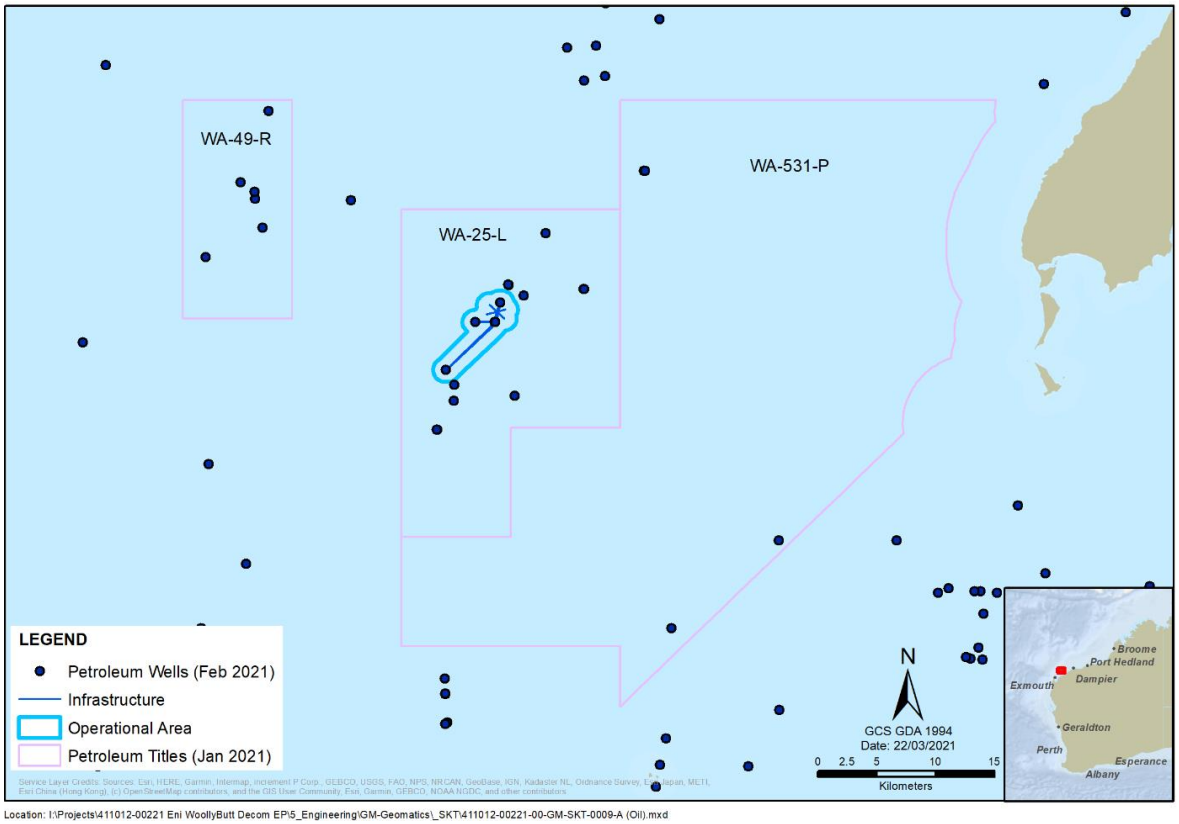

Figure 6-10: Oil and gas activity in the vicinity of the Woollybutt field

6.3.6 Cultural Heritage and Shipwrecks

Neither shipwrecks nor heritage sites are known to occur within the Operational Area (Commonwealth of Australia, 2012). The nearest shipwreck is the English ship *Tryal,* located approximately 110 km north-east of the Operational Area, which was wrecked on what are now known as the Tryal Rocks just north of the Montebello Islands in 1622. This shipwreck is protected by the *Marine Archaeological Act 1973* and has 'National Estate' status.

A further uncharted wreck (the 19th Century ship *Wild Wave*) is understood to be located on the seaward side of the southwest section of the Montebello's barrier reef. Two other wrecks, one believed to be of a lugger wrecked about 1915 and one of a more recent vessel, are reported in or near the vicinity of Willy Nilly Lagoon in the central part of the Montebello Islands.

6.4 Values and Sensitivities

No World Heritage Areas, Wetlands of International or National Significance, Australian marine parks, State marine protected areas or key ecological features overlap the Operational Area. The closest State marine protected areas are shown in Figure 6-11, the closest Australian Marine Parks are shown in Figure 6-12 and the closest key ecological features are shown in Figure 6-13.

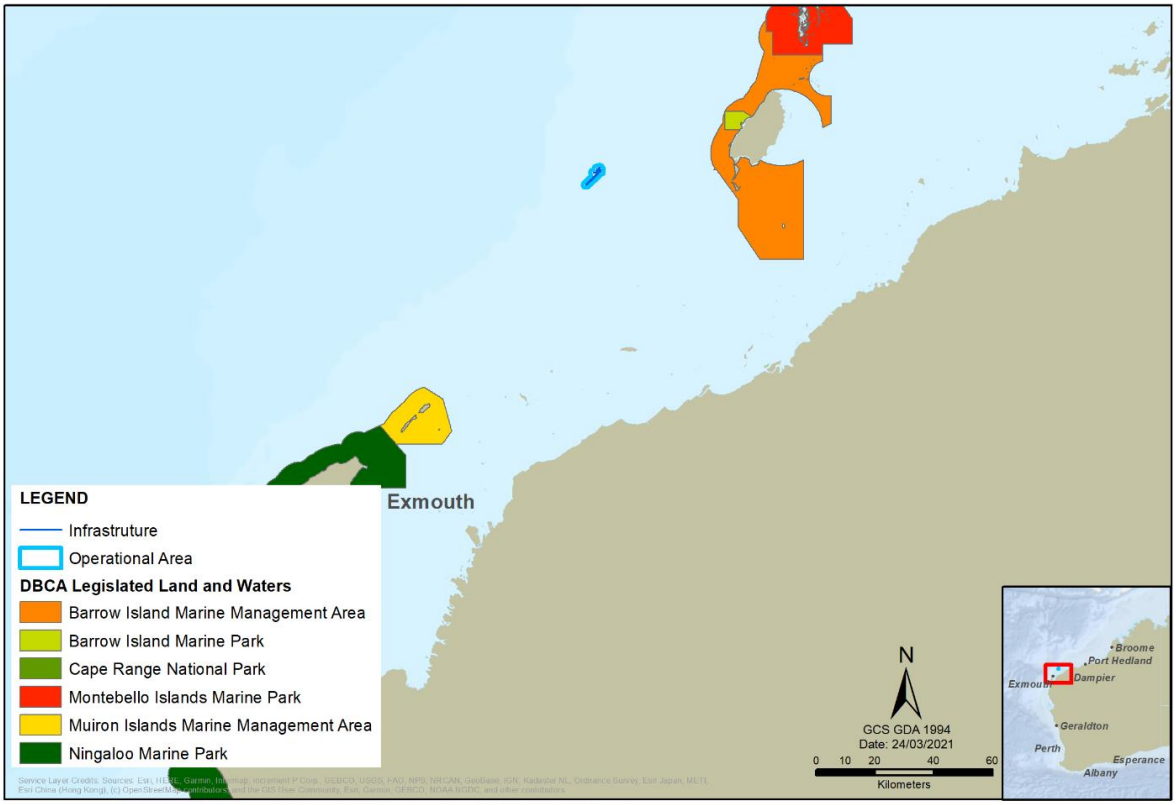

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Figure 6-11 State marine protected areas

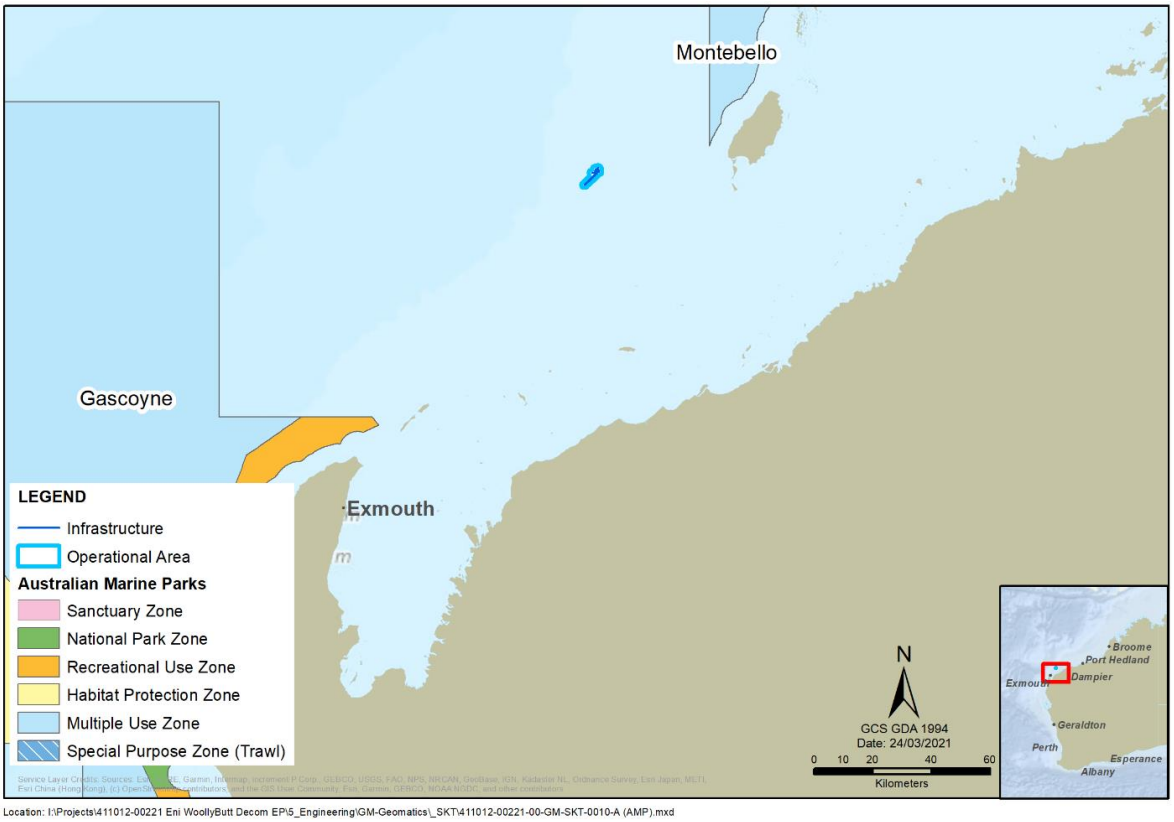

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Figure 6-12 Australian marine parks

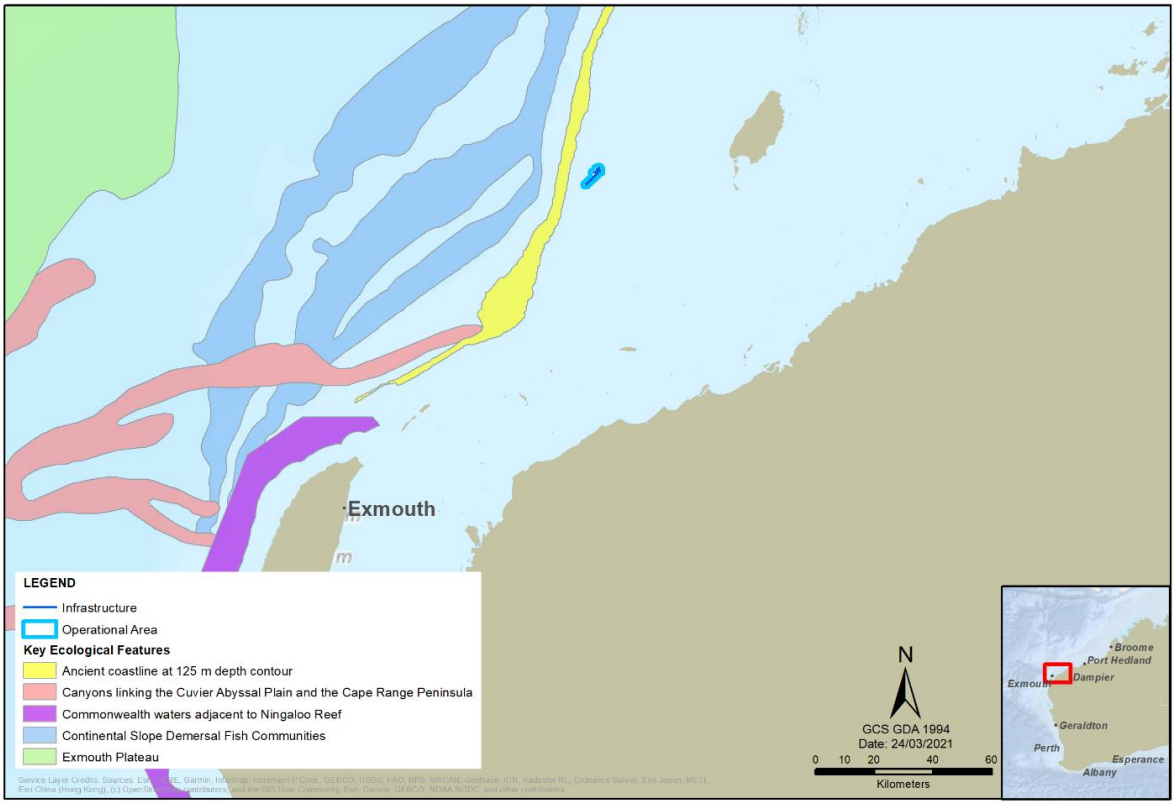

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Figure 6-13 Key ecological features

7 STAKEHOLDER CONSULTATION

7.1 Consultation Summary

In accordance with Regulation 16 of the OPGGS(E) Regulations, the EP must contain:

> *b) a report on all consultations between the titleholder and any relevant person, for regulation 11A, that contains:*
>
> - *A summary of each response made by a relevant person*
> - *An assessment of the merits of any objection or claim about the adverse impact of each activity to which the EP relates*
> - *A statement of the titleholder's response, or proposed response, if any, to each objection or claim.*

EAL has undertaken petroleum activities in the Woollybutt field since 2002. Therefore, EAL considers stakeholders, including marine users, well-informed regarding the location of the field and associated infrastructure. Consultation for the Woollybutt field activities have been extensive over the life of the field.

As part of the larger scale consultation regarding the Woollybutt field activities, EAL has specifically consulted relevant stakeholders regarding decommissioning activities that form the Petroleum Activities Program (see Section 7.3).

EAL has allowed each relevant person a reasonable period for assessing consultation material it provided. No objections were received from stakeholders in relation to the proposed decommissioning activities described in this EP.

EAL concludes all relevant stakeholders have been well-informed of upcoming activities in the Woollybutt field through ongoing discussions regarding decommissioning activities, as evidenced in Appendix C.

7.2 Identification of Relevant Stakeholders

In identifying relevant persons, hereafter referred to as stakeholders, EAL considered the following categories:

- Each Department or agency of the Commonwealth to which the activities to be performed under the EP, or the revision of the EP, may be relevant
- Each Department or agency of a State or the Northern Territory to which the activities to be performed under the EP, or the revision of the EP, may be relevant
- The Department of the responsible State Minister, or the responsible Northern Territory Minister
- A person or organisation whose functions, interests or activities may be affected by the activities to be performed under the EP, or the revision of the EP
- Any other person or organisation that the titleholder considers relevant.

Relevant stakeholders are summarised in Table 7-1.

Table 7-1: Relevant authorities, persons and organisations for consultation

Relevant Authority, Person or Organisation	Justification
Commonwealth Federal Government	
Australian Fisheries Management Authority	Australian Fisheries Management Authority is the Australian Government agency responsible for the efficient management and sustainable use of Commonwealth fish resources.
Australian Hydrographic Service (AHS) (now Australian Hydrographic Office or AHO)	The AHS is the Commonwealth Government agency responsible for publishing and distributing nautical charts and other information required for the safety of ships navigating in Australian waters.
Australian Maritime Safety Authority (AMSA)	AMSA is the national maritime agency whose responsibilities include protecting the marine environment from the impacts of shipping.
Department of Agriculture, Water and the Environment (DoAWE)	DoAWE implements the Australian Government's policies and programmes to protect and conserve the environment, water and heritage and promote climate action. In February 2015, environmental approvals were streamlined, with NOPSEMA becoming the sole assessor for offshore petroleum activities.
Department of Defence	The Australian Defence Force is constituted under the *Defence Act 1903*. Its mission is to defend Australia and its national interests. In fulfilling this mission, Defence serves the Government of the day and is accountable to the Commonwealth Parliament which represents the Australian people to efficiently and effectively carry out the Government's defence policy.
Western Australia State Government	
Department of Mine, Industry Regulation and Safety (formerly Department of Mines and Petroleum)	Responsible for ensuring the State's resources sector is developed and managed responsibly and sustainably for the benefit of all Western Australians. Prior to NOPSEMA it was the Designated Authority for adjacent Commonwealth waters.
Department of Primary Industries and Regional Development (formerly Department of Fisheries) (DPIRD)	Conserve, develop and manage Western Australian aquatic resources; commercial and recreational; fishing licencing; protecting aquatic environment and fish ecosystems.
Department of Biodiversity, Conservation and Attractions	Conserve Western Australia's biodiversity, cultural and natural values and providing world-recognised nature-based tourism and recreation experiences for the community. Includes the Parks and Wildlife Service.
Department of Transport	Provides support in the event of a marine oil spill reaching State waters.
Fishing Industry	
Commonwealth Fisheries Association	Industry Non-Government Organisation – Peak body representing the collective rights, responsibilities and interests of commercial fishing industry in Commonwealth regulated fisheries.
A Raptis and Sons	Owns and operates 15 commercial fishing vessels that work out of the Northern Prawn Fishery, the Gulf of Carpentaria Developmental Finfish Trawl Fishery, the Gulf of Saint Vincent and the Great Australian Bight Trawl Fishery as well as participating in many international fishing operations.

Relevant Authority, Person or Organisation	Justification
Pearl Producers Association	The Pearl Producers Association promotes the economic, social and environmental importance of the Australian pearling industry to key decision-makers and the wider community, formulating responses to issues that affect its members and assisting with the provision of strategic direction in support of Australian South Sea Pearl Producers.
Recfishwest	Industry Non-Government Organisation – Peak recreational fishing body and advocate for fisheries.
Western Australian Fishing Industry Council (WAFIC)	WAFICis Western Australia's peak industry body representing the interests of commercial fishing, pearling and aquaculture sectors.
Westmore Seafoods (Seafresh Holdings)	Fishing operator in the area holding three out of the 12 licences in the Pilbara Trawl Fishery; zero out of six licences in the Pilbara Trap Fishery and one out of 30 licences in the Onslow Prawn Fishery.
Southern Blue Fin Tuna Industry Association	WAFIC recommended consultation with Southern Blue Fin Tuna Industry Association as Western Australia is an important migratory route for Southern Blue Fin Tuna.
Tuna Australia	Formed in 2016, Tuna Australia represents statutory fishing right owners, holders, fish processors and sellers, and associate members of the Eastern and Western tuna and billfish fisheries of Australia.
Individual State Commercial Licence Holders	• Mackerel Managed Fishery • Onslow Prawn Managed Fishery • Pilbara Fish Trawl (Interim) Managed Fishery • Pilbara Trap Managed Fisher • Pilbara Line Fishery.
Individual Commonwealth Commercial Licence Holders	• Southern Bluefin Tuna Fishery • Western Tuna and Billfish Fishery.

7.3 Consultation Undertaken

EAL has undertaken specific stakeholder consultation with regard to the Petroleum Activities Program in March 2021. However, decommissioning activities were first introduced to stakeholders during the consultation that occurred for the P&A and removal activities EP in 2020.

Stakeholder consultation bulletins are provided in Appendix C and a summary of the responses and assessment of consultation is shown in Table 7-2.

No concerns were received from stakeholders in relation to the proposed Petroleum Activities Program.

Table 7-2: Consultation summary and assessment

Stakeholder	Consultation Summary	Consultation Feedback summary	EAL response
AFMA	24.05.2021 – Email update sent 04.05.2021 – Email update sent 24.03.2021 – Email update sent 09.03.2021 – Consultation letter (OPS.LT.6416.SD v2) sent confirming decommissioning strategy. 25.09.2020 – Consultation letter (OPS.LT.6230.SD) sent primarily outlining P&A and removal activities, but which also mentioned preliminary plans for decommissioning.	AFMA had not provided feedback on the activities proposed in this EP at the time of submitting the EP to NOPSEMA for assessment.	At the time this EP was submitted to NOPSEMA for assessment no direct response to AFMA was received. However, impacts to fisheries have been considered in this EP in Section 10.1.
AHO (previously AHS)	24.03.2021 – Email update sent 09.03.2021 – Consultation letter (OPS.LT.6416.SD v2) sent confirming decommissioning strategy. 25.09.2020 – Consultation letter (OPS.LT.6230.SD) sent primarily outlining P&A and removal activities, but which also mentioned preliminary plans for decommissioning.	AHO had not provided feedback on the activities proposed in this EP at the time of submitting the EP to NOPSEMA for assessment.	At the time this EP was submitted to NOPSEMA for assessment no direct response to AHO was received. However, impacts to other marine users have been considered in this EP in Section 10.1.
AMSA	24.03.2021 – Email update sent 11.03.2021 – Email received 09.03.2021 – Consultation letter (OPS.LT.6416.SD v2) sent confirming decommissioning strategy. 25.09.2020 – Consultation letter (OPS.LT.6230.SD) sent primarily outlining P&A and removal activities, but which also mentioned preliminary plans for decommissioning.	AMSA confirmed they have no concerns as the infrastructure will remain in situ and will not require any vessel-based activities.	No further response to AMSA required.

Stakeholder	Consultation Summary	Consultation Feedback summary	EAL response
DBCA (previously DPAW)	24.03.2021 – Email update sent 09.03.2021 – Consultation letter (OPS.LT.6416.SD v2) sent confirming decommissioning strategy. 25.09.2020 – Consultation letter (OPS.LT.6230.SD) sent primarily outlining P&A and removal activities, but which also mentioned preliminary plans for decommissioning.	DBCA had not provided feedback on the activities proposed in this EP at the time of submitting the EP to NOPSEMA for assessment.	At the time this EP was submitted to NOPSEMA for assessment no direct response to DBCA was received. The proposed activities are not located within waters or on lands managed by DBCA.
Department of Defence	24.03.2021 – Email update sent 09.03.2021 – Consultation letter (OPS.LT.6416.SD v2) sent confirming decommissioning strategy. 25.09.2020 – Consultation letter (OPS.LT.6230.SD) sent primarily outlining P&A and removal activities, but which also mentioned preliminary plans for decommissioning.	Department of Defence had not provided feedback on the activities proposed in this EP at the time of submitting the EP to NOPSEMA for assessment.	At the time this EP was submitted to NOPSEMA for assessment no direct response to Department of Defence was received. However, impacts to other marine users have been considered in this EP in Section 10.1.
DoT	07.04.2021 – Email received 24.03.2021 – Email update sent 18.03.2021 – Email received 09.03.2021 – Consultation letter (OPS.LT.6416.SD v2) sent confirming decommissioning strategy. 25.09.2020 – Consultation letter (OPS.LT.6230.SD) sent primarily outlining P&A and removal activities, but which also mentioned preliminary plans for decommissioning.	DoT acknowledged receipt of consultation material and confirmed consultation procedure that would need to be followed in the instance there is risk of oil spill impacting state waters.	EAL confirmed that there are no credible oil spill scenarios associated with the activities outlined in the EP.

Stakeholder	Consultation Summary	Consultation Feedback summary	EAL response
DoAWE	22.03.2021 – Teleconference between EAL and DoAWE 16.03.2021 – Email received with an update on the regulatory review of the sea dumping permitting framework 11.03.2021 – Consultation letter (OPS.LT.6416.SD v2) sent	DoAWE acknowledged EAL's proposed strategy and confirmed the abandonment of the remaining structures, as per this EP, requires approval under the Sea Dumping Act. DoAWE recommended applying for a permit to dispose of infrastructure at sea.	EAL informed DoAWE that it will submit sea dumping permit application(s) for the remaining equipment in 2021.
DMIRS (formerly DMP)	24.05.2021 – Email response sent 18.05.2021 – Email received 27.04.2021 – Email response sent 20.04.2021 – Email received 24.03.2021 – Email update sent 09.03.2021 – Consultation letter (OPS.LT.6416.SD v2) sent confirming decommissioning strategy. 25.09.2020 – Consultation letter (OPS.LT.6230.SD) sent primarily outlining P&A and removal activities, but which also mentioned preliminary plans for decommissioning.	DMIRS responded with the following questions: • Did the ERA identify any risks/impacts to State waters/lands from the proposed decommissioning approach? • Is all of the infrastructure mentioned in your email on the seabed (e.g. risers)? • Are there plastics in the infrastructure? If so, do you have an estimate of how much? • Have EAL considered measures for offsetting the plastics that may be discharged to the marine environment.	EAL responded confirming there are no direct impacts to State waters or lands, the infrastructure on the seabed will not extend beyond 1 m in height and provided volumes of plastics. EAL also confirmed that plastic offsets will are not planned to be committed to in the EP.

Stakeholder	Consultation Summary	Consultation Feedback summary	EAL response
DPIRD	09.08.2021 – Email sent 28.05.2021 – Email sent 17.05.2021 – Email sent 11.05.2021 – phone meeting 06.05.2021 – Email sent 24.03.2021 – Email received 24.03.2021 – Email update sent 10.03.2021 – Consultation letter (OPS.LT.6416.SD v2) sent confirming decommissioning strategy. 25.09.2020 – Consultation letter (OPS.LT.6230.SD) sent primarily outlining P&A and removal activities, but which also mentioned preliminary plans for decommissioning.	DPIRD confirmed receipt of consultation material. During the phone meeting DPRID noted that regular marine users are typically aware of long term structures on the seabed and have equipment to detect obstacles. DPIRD don't support over-trawling structures (as they can still present a snag risk after corrosion or scouring) and prefer equipment/obstacles to be marked on marine charts and recommend fishers to avoid trawling over equipment. DPIRD committed to sending formal feedback to EAL on the post the phone call proposal.	At the time this EP was submitted to NOPSEMA for assessment no formal response from DPIRD has been received However, impacts to other marine users, including fisheries, have been considered in this EP in Section 10.1.
Commonwealth Fisheries Association (CFA)	01.04.2021 – Email sent to alternative contact within CFA by WAFIC on behalf of EAL. 24.03.2021 – Email update sent 09.03.2021 – Consultation letter (OPS.LT.6416.SD v2) sent confirming decommissioning strategy. 25.09.2020 – Consultation letter (OPS.LT.6230.SD) sent primarily outlining P&A and removal activities, but which also mentioned preliminary plans for decommissioning.	CFA had not provided feedback on the activities proposed in this EP at the time of submitting the EP to NOPSEMA for assessment.	At the time this EP was submitted to NOPSEMA for assessment no direct response to CFA was required. However, impacts to other marine users, including commercials fisheries, have been considered in this EP in Section 10.1.

Stakeholder	Consultation Summary	Consultation Feedback summary	EAL response
Raptis and Sons	24.03.2021 – Email update sent 10.03.2021 – Email received 10.03.2021 – Consultation letter (OPS.LT.6416.SD v2) sent confirming decommissioning strategy. 25.09.2020 – Consultation letter (OPS.LT.6230.SD) sent primarily outlining P&A and removal activities, but which also mentioned preliminary plans for decommissioning.	Raptis confirmed they have no comment.	At the time this EP was submitted to NOPSEMA for assessment no direct response to Raptis and Sons was required. However, impacts to other marine users, including commercials fisheries, have been considered in this EP in Section 10.1.
Recfishwest	22.04.2021 – Email update sent 31.03.2021 – Email received 24.03.2021 – Email update sent 10.03.2021 – Consultation letter (OPS.LT.6416.SD v2) sent confirming decommissioning strategy. 25.09.2020 – Consultation letter (OPS.LT.6230.SD) sent primarily outlining P&A and removal activities, but which also mentioned preliminary plans for decommissioning.	Recfishwest responded with the request for more information to answer the following questions: • How was the recreational fishing community involved in the completed comparative assessment given it's a stakeholder? • How did EAL assess the environmental risks? How were these deemed low when degradation and fish habitat studies have not been completed? • What are the materials and potential contaminants in the subsea infrastructure to be decommissioned (particularly the umbilicals, flowlines and jumpers)? • What State and Commonwealth approvals processes will be undertaken to abandon this infrastructure?	EAL responded confirming the recreational fishing community was not directly involved in the comparative assessment, provided explanation of how risks were assessed, provided details of the materials and contaminants in the infrastructure and confirmed the State and Commonwealth approval process that have been or will be undertaken.
Western Australian Fishing Industry Council (WAFIC)	09.08.2021- Email sent 04.06.2021-Email received 24.05.2021-Email sent 19.05.20212-Email received 13.05.2021 – Meeting with WAFIC	WAFIC provided initial comments on how the fishing industry generally views leaving infrastructure in situ. WAFIC also provided advice on engaging with commercial fishers and agreed to review and dispatch	EAL provided further information on the following: • Dimensions of infrastructure to be left in situ

Stakeholder	Consultation Summary	Consultation Feedback summary	EAL response
	06.05.2021 – Email sent 06.05.2021 – Email received 05.05.2021 – Email sent 27.04.2021 – Email received 27.04.2021 – Email sent 09.04.2021 – Email received 06.04.2021 – Email sent 01.04.2021 – Email received 30.03.2021 – Email received 30.03.2021 – Email sent 26.03.2021 – Email received 26.03.2021 – Email sent 25.03.2021 – Email received 24.03.2021 – Email sent 16.03.2021 – Meeting with WAFIC, Advisian and EAL 12.03.2021 – Email received 08.03.2021 – Email sent and follow up telephone call made	consultation material to relevant parties on behalf of EAL. WAFIC provided specific comments in writing to EAL on the proposal. These comments raised concerns with: • Long term safety from plastic infrastructure being left in situ • Cumulative impacts of micro plastic pollution • Combined totals of plastics that are proposed to be left in situ • EAL's financial security to cover the cost of the risks in the future. Following EAL response to these points WAFIC remained concerned by the following: • Snag risk presented by the infrastructure left in situ • The legitimacy of the data EAL provided about the volume of plastics • The cumulative impact of plastics left in situ • Financial security to cover the cost of risks into the future	• Confirmation that infrastructure will be marked on navigational charts as a control • Information on how the infrastructure is expected to self-bury and degrade overtime, including timeframes for expected degradation • Confirmation that there are no credible scenarios where impacts from the activity would need to be addressed in the future. At the time this EP was submitted to NOPSEMA, consultation with WAFIC was ongoing.

Stakeholder	Consultation Summary	Consultation Feedback summary	EAL response
Westmore Seafoods (Seafresh Holdings)	24.03.2021 – Email update sent 10.03.2021 – Consultation letter (OPS.LT.6416.SD v2) sent confirming decommissioning strategy. 25.09.2020 – Consultation letter (OPS.LT.6230.SD) sent primarily outlining P&A and removal activities, but which also mentioned preliminary plans for decommissioning.	Seafresh Holdings had not provided feedback on the activities proposed in this EP at the time of submitting the EP to NOPSEMA for assessment.	At the time this EP was submitted to NOPSEMA for assessment no direct response to Seafresh Holdings was required. However, impacts to other marine users, including commercials fisheries, have been considered in this EP in Section 10.1.
Pearl Producers Association (PPA)	1.04.2021 – Email sent to alternative contact within PPA 24.03.2021 – Email update sent 10.03.2021 – Email sent to alternative contact provided by PPA 09.03.2021 – Email received 09.03.2021 – Consultation letter (OPS.LT.6416.SD v2) sent confirming decommissioning strategy. 25.09.2020 – Consultation letter (OPS.LT.6230.SD) sent primarily outlining P&A and removal activities, but which also mentioned preliminary plans for decommissioning.	PPA automatic email response was received on 09.03.2021 informing that the contact details EAL had on file were no longer up to date and provided alternative contacts within DPIRD. The DPIRD contacts had not provided feedback on behalf of PPA at the time of submitting the EP to NOPSEMA for assessment.	At the time this EP was submitted to NOPSEMA for assessment no direct response to PPA (via DPIRD) was required. However, impacts to other marine users, including commercials fisheries, have been considered in this EP in Section 10.1
Mackerel Managed Fishery (Area 2)	01.04.2021 - Email sent by WAFIC on behalf of EAL	At the time this EP was submitted to NOPSEMA no comment had been received.	At the time this EP was submitted to NOPSEMA for assessment no direct response was required. However, impacts to other marine users, including commercials fisheries, have been considered in this EP in Section 10.1

Stakeholder	Consultation Summary	Consultation Feedback summary	EAL response
Onslow Prawn Managed Fishery	01.04.2021 - Email sent by WAFIC on behalf of EAL	At the time this EP was submitted to NOPSEMA no comment had been received.	At the time this EP was submitted to NOPSEMA for assessment no direct response was required. However, impacts to other marine users, including commercials fisheries, have been considered in this EP in Section 10.1
Pilbara Trap Managed Fishery	01.04.2021 - Email sent by WAFIC on behalf of EAL	At the time this EP was submitted to NOPSEMA no comment had been received.	At the time this EP was submitted to NOPSEMA for assessment no direct response was required. However, impacts to other marine users, including commercials fisheries, have been considered in this EP in Section 10.1
Pilbara Trawl Interim Managed Fishery	01.04.2021 - Email sent by WAFIC on behalf of EAL	At the time this EP was submitted to NOPSEMA no comment had been received.	At the time this EP was submitted to NOPSEMA for assessment no direct response was required. However, impacts to other marine users, including commercials fisheries, have been considered in this EP in Section 10.1
Pilbara Line Fishery	01.04.2021 - Email sent by WAFIC on behalf of EAL	At the time this EP was submitted to NOPSEMA no comment had been received.	At the time this EP was submitted to NOPSEMA for assessment no direct response was required. However, impacts to other marine users, including commercials fisheries, have been considered in this EP in Section 10.1
Western Tuna and Billfish Fishery	01.04.2021 - Email sent by WAFIC on behalf of EAL	At the time this EP was submitted to NOPSEMA no comment had been received.	At the time this EP was submitted to NOPSEMA for assessment no direct response was required. However, impacts to other marine users, including commercials fisheries, have been considered in this EP in Section 10.1

Stakeholder	Consultation Summary	Consultation Feedback summary	EAL response
Australian Southern Bluefin Tuna Industry Association	01.04.2021 - Email sent by WAFIC on behalf of EAL	At the time this EP was submitted to NOPSEMA no comment had been received.	At the time this EP was submitted to NOPSEMA for assessment no direct response was required. However, impacts to other marine users, including commercials fisheries, have been considered in this EP in Section 10.1
Tuna Australia	01.04.2021 - Email sent by WAFIC on behalf of EAL	At the time this EP was submitted to NOPSEMA no comment had been received.	At the time this EP was submitted to NOPSEMA for assessment no direct response was required. However, impacts to other marine users, including commercials fisheries, have been considered in this EP in Section 10.1

7.4 Ongoing Consultation

Stakeholder consultation for the activities will be ongoing and EAL will work with stakeholders to address any future concerns if they arise throughout the duration of this EP. Should any new stakeholders be identified (see Section 7.1), they will be added to the stakeholder database and included in all future correspondence as required, including specific activity notifications.

Feedback gathered during the pre-activity consultation will inform stakeholder engagement requirements for ongoing consultation during the activity. Stakeholder Notification Letters will be distributed to stakeholders who requested ongoing consultation. If additional comments do arise, four weeks allows EAL an appropriate amount of time to respond and address these comments.

EAL will continue to accept feedback from all stakeholders during the assessment of this EP and throughout the duration of the accepted EP.

Additional consultation with relevant stakeholders will occur if there is a significant change to the proposed activities.

8 ENVIRONMENTAL RISK ASSESSMENT METHODOLOGY

8.1 Risk Assessment

In accordance with Regulation 13(5), the EP must include:

1. Details of the environmental impacts and risks for the activity
2. An evaluation of all the impacts and risks, appropriate to the nature and scale of each impact or risk
3. Details of the control measures that will be used to reduce the impacts and risks of the activity to as low as reasonably practicable and an acceptable level.

The EAL philosophy to manage environmental risks is to eliminate or mitigate the risk during the planning phase. Managing risks through design is contingent upon identifying, at an early stage in the project, the sources and pathways by which environmental impacts can occur and the sensitivities of the receiving environment in which the project is situated.

The expected or potential impacts associated with the Petroleum Activities Program were assessed using the EAL procedure *Risk Management and Hazard Identification* (ENI-HSE-PR-001). This procedure is consistent with the Australian Standard for Risk Management: *AS/NZS ISO 31000:2009 Risk management – Principles and guidelines* and provides a systematic process for:

1. Identifying each project activity and its associated environmental aspects
2. Identifying the environmental values within and adjacent to the area
3. Defining the potential environmental effects (impacts) of aspects identified in Step 1 above on the values identified in Step 2 above
4. Identifying the potential environmental consequences and severity of the impact (Table 8-2)
5. Identifying the likelihood of occurrence of the consequence, according to a six-level scale (Table 8-1)
6. Evaluating overall environmental risk levels using the EAL environmental risk matrix (Figure 8-1)
7. Identifying mitigation measures, assigning management actions and further recommended risk reduction measures according to risk levels (Table 8-3) to reduce the risk to ALARP.

Table 8-1: Likelihood scale

ID	Likelihood	Description
0	Non-credible	Theoretically possible but not known/reasonably expected to have occurred in the exploration and production industry
(A)	Rare	Reported for exploration and production industry (Freq 10-6 to 10-4/year)
(B)	Unlikely	Has occurred at least once in Company (Freq 10-4 to 10-3/year)
(C)	Credible	Has occurred several times in Company (Freq 10-3 to 10-1/year)
(D)	Probable	Happens several times per year in Company (Freq 10-1 to 1/year)
(E)	Almost certain/ will occur	Several times per year at one location (Freq > 1/year)

Table 8-2: Environmental consequence descriptors

Descriptor	Description
(1) Slight	No stakeholder impact or temporary impact on the area. Involved area < 0.1 sq. mile. Spill < 1 m³ – no sensitive impact on ground. Small discharges with confined and temporary impact on the area. No noticeable impact on water/air/soil and biodiversity. Negligible impact due to GHG emissions. Good materials/energy/water selection and use. Negligible financial consequences.
(2) Minor	Some local stakeholder concern or less than one week for clean-up or one year for natural recovery or impact on small no. of not-compromised species. Involved area < 1 sq. mile. Spill < 10 m³ – impact on localised ground. Sufficiently large discharges to impact the environment, but no long-lasting effect. Short term, localised impact on water/air/soil and biodiversity (on a limited no. of non-threatened species). Slight impact due to GHG emissions. Adequate materials/energy/water selection and use. Single breach of statutory or prescribed limit, or single complaint.
(3) Local	Regional stakeholder concern or one to two years for natural recovery or one week for clean-up or threatening to some species or impact on protected natural areas. Involved area < 10 sq. miles. Spill < 100 m³. Limited discharges affecting the neighbourhood and damaging the environment with longer effects. Short term, more widespread impact on water/air/soil and biodiversity (on a higher no. of non-threatened species). Limited impact due to GHG emissions. Inadequate materials/energy/water selection and use. Repeated breaches of statutory or prescribed limit, or many complaints.

Descriptor	Description
(4) Major	National stakeholder concern or impact on licences or two to five years for natural recovery or up to five months for clean-up or threatening to biodiversity or impact on interesting areas for science. Involved area < 100 sq. miles. Spill < 1000 m³. Large discharges with severe and long-lasting environmental damage. Medium-term, widespread impact on water/air/soil and biodiversity (on some threatened species and/or one ecosystem function). Extensive measures (financially significant) required to restore the impacted area. Significant impact due to GHG emissions. Poor materials/energy/water selection and use. Extended breaches of statutory or prescribed limits, or widespread nuisance.
(5) Extensive	International stakeholder concern or impact on licences/acquisitions or > 5 years for natural recovery or more than five months for clean-up or reduction of biodiversity or impact on special conservation areas. Involved area > 100 sq. miles. Spill > 1000 m³. Large discharges with severe and persistent environmental damage. Long term, large scale impact on water/air/soil and biodiversity (likely permanent species loss and impact on ecosystem function). Very poor materials/energy/water selection and use. Extensive impact due to GHG emissions. Major financial consequences for the Company. Ongoing breaches well above statutory or prescribed limits.

Consequence					Likelihood or Annual Frequency					
					0	A	B	C	D	E
Severity	Company Reputation	People (Health & Safety)	Environment	Assets / Project	0 - Non credible / Could happen in E&P industry (Freq <10-6 /y)	A - Rare / Reported for E&P industry (Freq 10-6 to 10-4 /y)	B - Unlikely / Has occurred at least once in Company (Freq 10-4 to 10-3 /y)	C - Credible / Has occurred several times in Company (Freq 10-3 to 10-1 /y)	D - Probable / Happens several times per year in Company (Freq 10-1 to 1 /y)	E - Frequent / Several times per year at one location (Freq >1 /y)
1	1-Slight impact	1-Slight health effect / injury	1-Slight effect	1-Slight damage	Low	Low	Low	Low	Low	Low
2	2-Minor impact	2-Minor health effect / injury	2-Minor effect	2-Minor damage	Low	Low	Low	Medium	Medium	Medium
3	3-Local impact	3-Major health effect / injury	3-Local effect	3-Local damage	Low	Low	Medium	Medium - High	High	High
4	4-National impact	4-PTD or single fatality	4-Major effect	4-Major damage	Low	Medium	Medium - High	High	High	High
5	5-International impact	5-Multiple fatalities	5-Extensive effect	5-Extensive damage	Medium	Medium - High	High	High	High	High

Figure 8-1: EAL environmental risk matrix

Table 8-3: Risk management actions

Risk Rating	Management Actions Required
Low (L)	*Continuous improvement:* The level of risk is broadly acceptable and generic control measures are required, aimed at avoiding deterioration. * Non-credible hazards require no further risk assessment.
Medium (M)	The level of risk can be tolerable only once a structured review of the risk reduction measures has been performed (where necessary, the relevant guidance from the local authorities should be adopted for application of ALARP).
Medium – High (orange)	
High (H)	*Intolerable risk:* The level of risk is not acceptable and risk control measures are required to lower the risk to another level of significance.

The environmental risk assessment process includes an analysis of inherent and residual risk levels. Inherent risk levels assume limited controls are in place. Residual risk levels are based on the application of further recommended risk reduction measures above and beyond those minimum standards, which drive the risk level down to ALARP.

8.2 Risk Reduction

Impacts or risks identified as requiring additional controls (the application of mitigation and management measures beyond what is standard practice for offshore petroleum activities) are subject to further review to identify the controls that are required to be provided or modified to reduce the residual risk.

Risk assessment is an iterative process of:

1. Identifying a risk
2. Assessing a risk
3. Deciding whether residual risk is tolerable
4. If not tolerable, generating a new risk or mitigation measures
5. Assessing the effectiveness of the mitigation measures.

The acceptability of a risk, after controls and mitigation measures have been applied, is determined in accordance with ratings and associated management actions outlined in Table 8-3.

8.3 ALARP and Acceptance Criteria

8.3.1 ALARP Criteria

The ALARP principle recognises that no industrial activity is entirely risk-free. ALARP is defined as a level of impact and risk that is acceptable and cannot be reduced further without expending costs that are disproportionate to the benefit gained. Cost may be in terms of financial, health, safety and schedule implications.

Regulation 10A(b) of the OPGGS(E) Regulations require a demonstration that environmental impacts will be reduced to ALARP. For risks to be considered to be reduced to ALARP, the criteria that must apply are:

- There are no reasonably practicable alternatives to the activity, or
- The cost (i.e., sacrifice) for implementing further measure is disproportionate to the reduction in risk.

When deciding whether risks are managed to ALARP, the items considered were:

- Risk level
- Existing layers of protection, including both preventive and mitigative controls
- Feasibility of additional controls or alternative arrangements
- Practicality of additional controls or alternative arrangements
- Cost of additional controls or alternative arrangements
- Effectiveness of additional controls or alternative arrangements
- Impact on risks from additional controls or alternative arrangements.

8.3.2 Acceptance Criteria

Regulation 10A(c) of the OPGGS(E) Regulations require a demonstration that environmental impacts are of an acceptable level.

EAL considers a range of factors when evaluating the acceptability of environmental impacts associated with its activities. This evaluation is outlined in Table 8-4.

Table 8-4: EAL acceptability factors

Demonstration of Acceptability	
Compliance with Legal Requirements/Laws/ Standards	Considers the legal aspect, particularly compliance with applicable legislative prescriptions and/or regulations in force which imply specific procedures to be performed by the Titleholder to control the environmental aspect.
Policy Compliance	The risk or impact must comply with the objectives of EAL policies.
Social Acceptability	Considers the 'social' aspects that can alter stakeholder perception on the Titleholder's commitment regarding the safeguard and protection of the environment and that can cause serious harm to the Titleholder's public image.
Area Sensitivity/ Biodiversity	The proposed risk or impact controls, environmental performance outcomes and standards must be consistent with the nature of the receiving environment.
Principles of Environmentally Sustainable Development	The overall activity is consistent with the APPEA Principles of Conduct.
ALARP	There is a consensus among the risk assessment team that risks, or impacts are ALARP.

8.4 Risk Identification and Assessments

Risk identification and assessment for the Petroleum Activities Program was undertaken through a series of assessments and workshops. Firstly, a comparative assessment was undertaken to inform the decommissioning strategy and identify the preferred decommissioning option. Although this process was intended to identify a preferred option, the process included identification and ranking of environmental, technical, health and safety, economic and socio-economic impacts associated with all options, including the option that forms the Petroleum Activities Program. The comparative assessment was informed by a workshop that was held on Wednesday 5 September 2018, and which was attended by engineering, health and safety and environmental professionals from EAL and Advisian. The outcomes of the comparative assessment have since been reviewed and updated for the scope of this EP and revised to incorporate outcomes from studies that have been undertaken, including degradation and fish habitat studies.

The decommissioning options have also been assessed using an options assessment process, where each option was compared with the base case and tested against "equal or better outcomes" criteria. This assessment was undertaken by an environmental professional and reviewed by EAL. The options assessment was designed so detailed environmental risk and impacts could be identified and ranked in accordance with the EAL risk assessment methodology. The option that presented better or equal outcomes was then carried forward as the Petroleum Activities Program. Risks and impacts identified during the options assessment have been assessed in this EP, including ALARP and acceptability assessments.

Environmental risks from planned activities and unplanned events are provided in Sections 9 and 10 respectively. Performance outcomes, standards and measurement criteria are outlined in Section 11.

9 PLANNED ACTIVITIES- LEAVING INFRASTRUCTURE IN-SITU

9.1 Benthic Habitat (Risk ID 1)

9.1.1 Summary of Environmental Risk

Table 9-1: Long term physical presence of infrastructure

Hazard	Benthic Habitat		
	Frequency	Severity	Risk
Residual Risk	A	1	L

9.1.2 Description of Hazard

The long-term physical presence of infrastructure has the potential to cause localised seabed disturbance and altering of benthic habitats. Infrastructure provides hard substrate resulting in the creation of new habitat as described in Section 4.3.

9.1.3 Potential Environmental Impact

Potential environmental impacts to benthic habitat include:

- Localised physical modification to the seabed and localised disturbance to soft sediments.
- Provision of hard substrate and benthic habitat. Atteris predict that over the next 10-30 years infrastructure will self-bury up to 60-90%. Burial to a degree will limit the availability of hard substrate for benthos to attach to and grow, however benthos can still grow on hard surfaces where they exist just beneath the surface. Burial is unlikely to result in the complete loss of colonising benthos although it may change the nature and abundance of colonising benthos.

9.1.3.1 Physical Modification to the Seabed and Soft Sediments

The physical presence of infrastructure of the seabed can interact with surrounding hydrodynamic conditions potentially resulting in disturbance to the seabed (scouring and accretion) which may impact associated benthic habitats.

Studies have been conducted on the effects of sediment movements associated with anthropogenic structures on the seabed. These studies indicate impacts from structures such as shipwrecks and artificial reefs are limited to within 10 m of the structure (Smiley, 2006; Lewis and Pagano, 2015).

The Operational Area does not overlap any key ecological features or other notable seabed features. However, it has been identified as having sediment-burrowing infauna and surface epifauna invertebrates, impacts will continue to be localised to the footprint of the infrastructure and the areas immediately adjacent to it.

9.1.3.2 Provision of Hard Substrate and Benthic Habitat

EAL has completed fish habitat studies and infrastructure degradation studies to understand the long-term impacts of leaving infrastructure in-situ. Results from fish

habitat surveys have found benthic communities along pipelines including including bryozoa, soft corals and sponges in a range of morphologies (McLean et al. 2021). Epibenthic communities are also present in densities of up to 75% cover with 71% of quadrates used in the study having biota >40 cm in height (McLean et al. 2021).

The benthic habitat on the infrastructure supports commercially valuable fish species. A total of 19 commercially important species were observed with the most common commercially important species including cardinal fish (*Apogonidae spp*.), Areolate grouper (*Epinephelus areolatus*) and various snapper species (*Lutjanius quinquelineatus, L.malabaricus, Lutjanus vitta*) (McLean et al. 2021). The density of commercially important species was recorded to be 195 fish per 1 km of pipeline (McLean et al. 2021).

The hard substrate provided by the infrastructure is likely to continue to host benthic habitat until it has completely self-buried (30 years) and at various degrees until it has completely degraded (up to 10,000 years) (McLean et al. 2021).

More recently, McLean et al. (2020) identified that uniform coverage of encrusting marine growth and patchy occurrences of more structurally complex sponges existed along the Pluto pipeline in the portion that traverses the Montebello Australian Marine Park. This habitat was found to support an abundance of commercially targeted Moses' snapper which correlated positively with increasing cover of sponges. As the Montebello Australian Marine Park covers waters up to 150 m in depth (Australian Marine Parks, 2021), this study is also considered representative of the habitats that may be present, or that have potential to establish along the Woollybutt infrastructure (McLean et al. 2021).

9.1.4 Environmental Performance Outcomes and Control Measures

During the evaluation of the potential impacts to benthic habitat, it was determined that no control measures were available that would further reduce the likelihood or consequence of the impact. Therefore, no additional management controls are required to reduce the risk to ALARP. Risk is ALARP and acceptable in its current state.

9.1.5 ALARP Demonstration

Type	Control/ management	Evaluation	Adoption?
Eliminate	Removal of subsea equipment	Section 4 determined that leaving the infrastructure in situ provides equal environmental outcomes compared to complete removal. Furthermore, infrastructure has the potential to provide a benefit due to the creation of a hard substrate habitat on a seabed predominantly comprised of soft sediment.	x
Substitute	N/A	N/A.	N/A
Engineering	N/A	N/A.	N/A
Isolation	N/A	N/A.	N/A

Type	Control/ management	Evaluation	Adoption?
Administrative	Implement a Monitoring Program	Studies have shown the degradation of the subsea equipment will occur over a period of thousands of years (up to 1200 years for metals and 10,000 years for plastics), therefore the rate of change is predicted to be slow and unlikely to be easily detected over short to medium timeframes. Given the timeframe for breakdown of materials, ongoing monitoring is impractical.	x

9.1.6 Acceptability Demonstration

Demonstration of Acceptability	
Compliance with Legal Requirements/Laws/ Standards	The Petroleum Activities Program is in compliance with EPBC 2001/365 approval. Prior to permanently leaving any structure in situ, EAL will obtain a Sea Dumping Permit in accordance with the requirements of the Sea Dumping Act.
Policy Compliance	EAL's HSE Statement objectives will be met.
Social Acceptability	Stakeholder consultation has been undertaken. No stakeholder concerns have been raised with regard to benthic habitat.
Area Sensitivity/ Biodiversity	The provision of hard substrate for benthic habitats will benefit the existing environment.
ESD Principles	The impact assessment presented throughout this EP demonstrates compliance with the principles of ESD.
ALARP	The residual risk demonstrates to be ALARP.

Leaving infrastructure in situ has the potential to provide an economic benefit to commercial fishers in the medium-term, through attraction of commercial fish species due to creation of hard substrate habitat on a seabed otherwise comprised of soft sediment.

Although there are ongoing, localised impacts to the seabed from the long-term physical presence of infrastructure, these impacts are not expected to extend beyond 10 m from the infrastructure footprint (Smiley, 2006; Lewis and Pagano, 2015).

There are no controls available that would further reduce impacts to benthic habitats and therefore the impact is ALARP. The residual low impact is considered acceptable on the basis that the infrastructure supports benthic habitats that provide habitat to commercially-important species and is not otherwise present in the surrounding environment.

9.2 Marine Discharges from Corrosion (Risk ID 2)

9.2.1 Summary of Environmental Risk

Hazard	Marine Discharges		
	Frequency	Severity	Risk
Residual Risk	B	1	L

9.2.2 Description of Hazard

Corrosion of metals and concrete within the subsea infrastructure will occur over time, causing particles to be released to the marine environment. Degradation of the infrastructure is detailed in Section 5.8.1.

Specifically, there is approximately 380 m^3 of metal associated with subsea infrastructure (flowlines, umbilicals, anchors and mooring chains) and 12 m^3 of concrete associated with mattresses and grout bags. The composition of each infrastructure component is outlined in Section 5.7.

The metal components that have been identified within the subsea infrastructure include steel, steel alloys, lead, aluminium and copper. The exact composition of the concrete is unknown.

9.2.3 Potential Environmental Impact

Potential environmental impacts from corrosion include:

- Discharge of trace amounts of metals and concrete to the marine environment.

9.2.3.1 Discharge of Trace Amounts of Metals

As the infrastructure is left in situ, the metals in the flowlines, umbilicals, anchors and chains and concrete in the mattresses and grout bags will eventually corrode, which will result in the discharge of trace amounts of metals to the marine environment over time.

Corrosion particles

EAL commissioned Atteris to study the degradation of the various equipment and components within the Woollybutt field. The report identifies the potential composition of particles that could enter the marine environment following corrosion of metals on the infrastructure. The report also determines whether the particles have the potential to be toxic in the marine environment.

The metal components of the infrastructure are predominantly comprised of mild steel. Iron is not considered a significant contaminant in the marine environment and is only toxic to marine organisms at high concentrations (Grimwood and Dixon, 1997) and is an abundant element in marine sedimentary systems (Taylor et al, 2011).

The remaining metals (approximately 1.5% of the total metals) in the infrastructure are lead, copper and steel alloy. The corrosion of lead, copper and steel alloy is identified as having the potential to release a number of compounds, including lead carbonate, potassium dichromate, chromatic chloride, copper oxide and copper chloride compound.

None of the metals are listed as "bioaccumulative" by Australian and New Zealand Environment and Conservation Council and the metals are not likely to be present in a bioavailable form, given the pH of the ocean and the fact they originate from hard metal parts. Furthermore, these components make up a very small portion of the infrastructure and are unlikely to exist in harmful concentrations (Atteris, 2021).

Although the exact composition of the concrete in the Woollybutt field is unknown, concrete components are usually chemically inert. This indicates corrosion products from concrete will not react in the marine environment (Atteris, 2021).

Fate of corrosion particles

For most metals the corrosion particles have a "significantly higher" density than seawater and are therefore likely to settle on the seabed within the Operational Area. It is expected that only a small amount of material will become dissolved in the water column.

Similarly, concrete also has a "significantly higher" density than seawater and is therefore also likely to remain in the Operational Area. Concrete is likely to degrade, with large pieces initially breaking off the infrastructure, which then are likely to erode into smaller particles and aggregate (Atteris, 2021). The breakdown of material is a slow process (up to 1200 years), and the small amount of material in the water column will undergo rapid dilution in the open water marine environment (Atteris 2021).

The operational area is predominantly comprised of soft substrates with no significant habitats (Section 6.1). There are KEFS nearby the Operational Area, with the closest being the Ancient Coastline at 125 m Depth Contour approximately 8 km northwest. The habitat types associated with the hard substrate (encrusting assemblages, such as soft corals and sponges) that characterise the Ancient KEF coastline as not considered to be unique (Falkner et al. 2019). Based on the slow degradation rate of material, rapid dilution in the open water environment and low sensitivity habitat, impacts are likely to be negligible.

Seven species of whale, five turtle species and several fish species have the potential to occur within the operational area (Section 6.2). Based on the transitory nature of species and the low density of corrosion particles in the water column, impacts to species are likely to negligible.

9.2.4 Environmental Performance Outcomes and Control Measures

During the evaluation of the potential impacts of discharges from corrosion and degradation of the subsea infrastructure, it was determined that no control measures were available that would further reduce the likelihood or consequence of the impact. Therefore, no additional management controls are required to reduce the risk to ALARP. Risk is ALARP and acceptable in its current state.

9.2.5 ALARP Demonstration

Type	Control/ management	Evaluation	Adoption?
Eliminate	Removal of subsea equipment	Section 3 determined that leaving the infrastructure in situ provides equal environmental outcomes compared to complete removal. Furthermore, infrastructure has the potential to provide a benefit due to the creation of a hard substrate habitat on a seabed predominantly comprised of soft sediment.	x
Substitute	N/A	N/A.	N/A
Engineering	N/A	N/A.	N/A
Isolation	N/A	N/A.	N/A
Administrative	Implement a monitoring program	Studies have shown the degradation of the subsea equipment will occur over a period of thousands of years (up to 1200 years for metals and 10,000 years for plastics), therefore the rate of change is predicted to be slow and unlikely to be easily detected over short to medium timeframes. Given the timeframe for breakdown of materials, ongoing monitoring is impractical.	x

9.2.6 Acceptability Demonstration

Demonstration of Acceptability	
Compliance with Legal Requirements/Laws/ Standards	The Petroleum Activities Program is in compliance with EPBC 2001/365 approval. Prior to permanently leaving any structure in-situ, EAL will obtain a Sea Dumping Permit in accordance with the requirements of the Sea Dumping Act.
Policy Compliance	EAL's HSE Statement objectives will be met.
Social Acceptability	Stakeholder consultation has been undertaken. No stakeholder concerns have been raised regarding corrosion of metals and concrete.
Area Sensitivity/ Biodiversity	The remainder of corrosion particles will remain in the Operational Area, which does not overlap any sensitive areas. Dissolved particles are unlikely to reach concentrations that impact sensitive areas nearby (with the closest being 8 km from the Operational Area).
ESD Principles	The impact assessment presented throughout this EP demonstrates compliance with the principles of ESD.
ALARP	The residual risk has been demonstrated to be ALARP.

Impacts to the marine environment from the corrosion of metals and concrete are expected to be low. This is on the basis that the majority of corrosion products are non-toxic and unlikely to become bioavailable, given the pH of the seawater and the origin of the particles (Atteris, 2021). Based on the density of corrosion material, the majority of particles will settle within the Operational area where there is no significant benthic habitat. The materials will also breakdown slowly and undergo rapid dilution in the open water marine environment.

The impact is considered ALARP. Full removal of infrastructure was considered as a control measure. The cost and impacts associated with removing infrastructure are considered to outweigh the benefits; see Section 4.6 for a full assessment of the potential impacts associated with removing infrastructure.

The residual impact is considered acceptable. This is on the basis that the impacts would largely be localised and restricted to within the Operational Area where there are no sensitive receptors. Furthermore, corrosion will only release small amounts of materials to the marine environment over long periods of time at concentrations unlikely to impact marine species or nearby protected areas.

9.3 Marine Waste from the Breakdown of Plastics (Risk ID 3)

9.3.1 Summary of Environmental Risk

Hazard	Atmospheric Emissions		
	Frequency	Severity	Risk
Residual Risk	B	2	L

9.3.2 Description of Hazard

The Woollybutt field infrastructure contains plastic, primarily within the umbilicals and flexible flowlines with small amounts in the stabilisation mattresses and grout bags (Section 5.7). It is expected that it will take 1,000 to 10,000 years for the plastic to fully degrade (Atteris, 2021). It is also expected that the infrastructure will self-bury between 60 to 90%, which will see most degraded plastic remaining in situ and 10 to 40% potentially being released beyond the infrastructure footprint (Atteris, 2021).

9.3.3 Potential Environmental Impact

Potential environmental impacts from the breakdown of plastics include:

- Release of macro and micro plastics to the marine environment.

Materials likely to be released to the environment:

Plastics present in the Woollybutt infrastructure include polyethylene, polyamide-11, polypropylene, polyvinylidene difluoride, polyester, polyvinyl chloride, aramid fibre and polyurethane (Atteris, 2021). These are broadly categorised into polymers and polyester/aramid fibre tape. When left in the marine environment over long periods of time (thousands of years), these materials will break down and degrade through a number of different degradation processes, as detailed in Table 9-2.

Table 9-2: Estimated material breakdown degradation processes/events (Atteris, 2021)

Material	Estimated degradation process/events leading to material breakup	
	Small Particles	Large Particles
Polymers	• Biotic degradation • Abiotic degradation.	• Extreme environmental loading • External impact.
Polyester/aramid fibre tape	• Relatively uniform corrosion.	• Extreme environmental loading • External impact • Very irregular corrosion.

Plastic degrades into smaller particles referred to as microplastics and macroplastics. Atteris (2021) defines microplastics as synthetic organic polymer particles with a size less than 5 mm and macroplastics as synthetic organic polymer particles with a size greater than 5 mm. The various sizes and densities of degraded plastics will impact their fate in the receiving environment. Therefore, to understand the potential impacts of the

Petroleum Activities Program on the receiving environment, it is useful to understand the expected characteristics of particles after they have broken away from the infrastructure. Modelling conducted by Atteris (2021) has identified the likely particle sizes from each component of the infrastructure as well as the expected dispersion of those particles, detailed in Table 9-3.

Table 9-3: Estimated material breakdown outcomes (Atteris, 2021)

Material	Infrastructure	Estimated Material Breakdown Size and Causing Event			Estimated Dispersion Characteristics
		Lower Bound Size	Upper Bound Size	Likely Size and Event	
Polyethylene	Flowlines- outer sheath Umbilicals- insultation, outer and inner sheath	Micro Plastics <<1 mm Abrasion by seabed particles may cause weakened material to dislodge	Large Pieces >10 cm Dragged anchor strike or extreme environmental loading may cause breakaway of large pieces Environmental loading is unlikely to have enough load at approximately 100 m water depth to cause breakdown	Small and Micro Particles <1 cm Dislodgement likely to be caused by abrasion, environmental loading, weight of marine growth and marine fauna activity	**Flowlines:** Much of the flowlines are expected to be buried by the time the plastic sheaths start to degrade. Any portion of the flexibles below the regional scour depth are likely to remain buried. Buried material is unlikely to disperse. Small, exposed pieces are likely to float and be very widely dispersed due to lower density than seawater (SG ~0.9 to 1.2). Larger pieces are likely to erode into microplastics. **Umbilicals:** Small, exposed pieces are likely to float and be very widely dispersed due to lower density than seawater (SG ~ 0.9 to 1.2). Larger pieces are likely to erode into microplastics.
Polyamide-11	Flowlines-Anti-wear layer, inner lining and outer sheath Umbilicals-liner	Micro Plastics <<1 mm Abrasion by seabed particles may cause weakened material to dislodge	Large Pieces >10 cm Dragged anchor strike or extreme environmental loading may cause breakaway of large pieces Environmental loading is unlikely to have enough load at approximately 100 m	Small and Micro Particles <1 cm Dislodgement likely to be caused by abrasion, environmental loading, weight of marine growth and marine fauna activity	**Flowlines:** Much of the flexibles are expected to be buried by the time the plastic sheaths start to degrade. Any portion of the flexibles below the regional scour depth are likely to remain buried. Buried material is unlikely to disperse. Any exposed pieces are likely to disperse widely due to regional scour as Nylon-11 is only slightly denser that seawater (SG ~1.00).

Material	Infrastructure	Estimated Material Breakdown Size and Causing Event			Estimated Dispersion Characteristics
		Lower Bound Size	**Upper Bound Size**	**Likely Size and Event**	
			water depth to cause breakdown		**Umbilicals:** Any exposed pieces are likely to disperse widely due to regional scour as Nylon-11 is only slightly denser that seawater (SG ~1.0).
Polypropylene	Umbilicals-cable filler	Micro Plastics <<1 mm Abrasion by seabed particles may cause weakened material to dislodge.	Large Pieces >10 cm Dragged anchor strike or extreme environmental loading may cause breakaway of large pieces. Environmental loading is unlikely to have enough load at approximately 100 m water depth to cause breakdown.	Small and Micro Particles <1 cm Dislodgement likely to be caused by abrasion, environmental loading, weight of marine growth and marine fauna activity.	**Flowlines:** Much of the flexibles are expected to be buried by the time the plastic sheaths start to degrade. Buried material is unlikely to disperse. Small, exposed pieces are likely to float and be very widely dispersed due to lower density than seawater (SG ~0.9). Larger pieces are likely to erode into microplastics. **Umbilicals:** Small, exposed pieces are likely to float and be dispersed very widely due to lower density than seawater (SG ~ 0.9). Larger pieces are likely to erode into microplastics.

Material	Infrastructure	Estimated Material Breakdown Size and Causing Event			Estimated Dispersion Characteristics
		Lower Bound Size	Upper Bound Size	Likely Size and Event	
Polyvinylidene difluoride	Flowlines-inner lining	Micro Fibres <<1 mm in length Small lengths of individual fibres may be fractured off the tape by abrasion or loading at weakened points.	Lengths of Tape >10 cm in length Dragged anchor strike causing major damage to flowline and sheath causing breakaway of large pieces. Environmental loading is unlikely to be sufficient at approximately 100 m water depth.	Small and Micro Fibres <1 cm Dislodgement likely to be caused by abrasion, environmental loading, weight of marine growth and marine fauna activity.	**Flowlines:** Much of the flexibles are expected to be buried by the time the plastic sheaths start to degrade. Any portion of the flexibles below the regional scour depth are likely to remain buried. Buried material is unlikely to disperse. Any exposed pieces are likely to disperse in the surrounding area due to regional scour and eventually be incorporated into the seabed, as polyvinylidene difluoride is denser that seawater (SG ~ 1.74).
Polyester	Flowlines-inner lining and intermediate layers. Umbilicals-outer sheath.	Micro Fibres <<1mm in length Small lengths of individual fibres may be fractured off the tape by abrasion or loading at weakened points in the glass fibre.	Lengths of Tape >10 cm in length Dragged anchor strike causing major damage to flowline and sheath causing breakaway of large pieces. Environmental loading is unlikely to be sufficient at approximately 100 m water depth.	Small and Micro Fibres <1 cm Dislodgement likely to be caused by abrasion, environmental loading, weight of marine growth and marine fauna activity.	**Flowlines:** Much of the flexibles are expected to be buried by the time the plastic sheaths start to degrade. Any portion of the flexibles below the regional scour depth are likely to remain buried. Buried material is unlikely to disperse. Any exposed pieces are likely to disperse widely due to regional scour as polyester is only slightly denser that seawater (SG ~1.5). Larger fibres are likely to erode and fracture into micro fibres.
Aramid fibre	Umbilicals-reinforcement	Micro Fibres <<1mm in length	Fibres <10 cm in length	Small and Micro Fibres <1 cm	**Umbilicals:** Any exposed pieces are likely to disperse widely due to regional scour as Aramid

Material	Infrastructure	Estimated Material Breakdown Size and Causing Event			Estimated Dispersion Characteristics
		Lower Bound Size	**Upper Bound Size**	**Likely Size and Event**	
		Small lengths of individual fibres may be fractured off the tape by abrasion or loading at weakened points in the glass fibre.	Dragged anchor strike causing major damage causing breakaway of large pieces. Environmental loading is unlikely to have enough load at approximately 100 m water depth to cause breakdown.	Dislodgement likely to be caused by abrasion, environmental loading, weight of marine growth and marine fauna activity.	Fibre is only slightly denser than seawater (SG ~ 1.4).
Polyurethane	Umbilicals-cable filler and cable outer	Micro Plastics <<1 mm Abrasion by seabed particles may cause weakened material to dislodge.	Large Flakes >1 cm Dragged anchor strike or extreme environmental loading may cause breakaway of large pieces. Environmental loading is unlikely to have enough load at approximately 100 m water depth to cause breakdown.	Small and Micro Particles <5 mm Dislodgement likely to be caused by abrasion, environmental loading, weight of marine growth and marine fauna activity.	**Umbilicals:** Sections of the umbilicals are likely to remain permanently buried, any material in these sections which lie below the regional scour depth will remain buried. Buried material is unlikely to disperse. Small, exposed pieces are likely to float and be very widely dispersed due to having a lower density than seawater (SG ~ 0.03). Larger pieces are likely to erode into microplastics.

Impacts to Sensitive Receptors

Sensitive receptors within the marine environment may interact with plastic debris through:

- Direct ingestion via accidental consumption of particles through indiscriminate feeding strategies such as filter-feeders or active selection due to misidentification of microplastics for food
- Indirect ingestion either through eating prey or scavenging detrital matter containing microplastic
- Adhering to external appendages, such as gills and setae and adhesion to phytoplankton (Atteris, 2021).

Toxicity hazards may be presented to the marine environment due to:

- Residual monomers and additives from manufacture present in the plastic or additives used in the plastic, which can leach over time
- Intermediates from partial degradation of plastics
- Persistent organic pollutants present in the seawater, adsorbed and concentrated in microplastic fragments (Atteris, 2021).

Marine Fauna

Marine fauna are known to be impacted by plastic debris in the marine environment, with evidence suggesting plastics can be found in marine fauna at all trophic levels across the world (GESAMP, 2015). Plastic impacts to wildlife can occur directly through entanglement and ingestion and indirectly through chemical effects (CSIRO, 2021). However, a report by the Joint Group of Experts on the Scientific Aspects of Marine Environmental Protection (GESAMP) (2016) found that the risk of impacts from being exposed to plastics depends on a number of factors. These include:

- The number of particles
- The type of particles
- The duration of exposure
- The concentration and type of contaminants associated with the plastic
- The physiology and life-history of the organism (GESAMP, 2016).

The Atteris report assesses the impacts of plastics on marine species, including plankton, fish, marine mammals, marine reptiles and birds. In all instances, species can interact with marine plastics through passive and active pathways. This includes confusing plastic with prey, accidental update while foraging, and transfer through the food chain through biomagnification (Atteris, 2021).

Plastics may enter the food chain via phytoplankton and zooplankton which are then readily ingested by other marine species. Fish in particular can also passively ingest plastics through their gill system. As water contaminated with microplastics flows over their gills, the plastics can be absorbed.

Section 6.2 outlines the listed threatened and migratory species that may occur in the Operational Area. In addition to the potential presence for these species in the Operational Area, BIAs for the flatback turtle, humpback whale, wedge-tailed shearwater and whale shark also overlap the Operational Area.

The flatback turtle BIA is identified as an internesting buffer and does not represent foraging habitat. Furthermore the deep, offshore nature of the Operational Area suggests that foraging marine turtles would not be expected. However, marine debris, including marine plastics, has been identified as a threat for marine turtles in the Recovery Plan for Marine Turtles in Australia 2017-2027 (Commonwealth of Australia, 2017) and a full assessment of the proposal against the objectives and actions of this document has been undertaken in Table 9-4. Based on the slow-release rate of marine plastics to the environment the impact is expected to be low.

The foraging BIA for the wedge tailed shearwater and whale shark overlaps the Operational Area. The distribution BIA for the pygmy blue whale and migration BIA for the humpback whale also overlaps the operational area. Therefore, it is credible that these species could ingest plastics, and this is supported by studies that have been conducted on seabirds which found plastics within their stomachs (Bergmann et al. 2015). However, the degradation modelling by Atteris (2020) shows that the majority of plastics will breakdown and remain in situ and the rate that the remaining plastics enter the marine environment is slow. When considering the factors that contribute to the exposure of marine fauna to plastics as published by GESAMP (2016), it is unlikely these species would interact with a significant number of plastic particles from the equipment at any given time and therefore the potential impacts from exposure to plastics considered to be low. To further support this assessment against recovery plans and conservation advice relevant to the whale shark and wedge-tailed shearwater has been included in Table 9-4. It has been found that the proposal is not inconsistent with the relevant objectives and actions set by DoAWE.

Consistency with Recovery Plans and Conservation Advice

To protect the threatened and migratory species with potential to be in the Operational Area, and some of those with BIAs that overlap the Operational Area, DoAWE has implemented recovery plans, threat abatement plans and conservation advice. Relevant to the Petroleum Activities Program are:

- Threat Abatement Plan for the Impacts of Marine Debris on the Vertebrate Wildlife of Australia's Coasts and Oceans
- Sawfish and River Sharks Multispecies Recovery Plan: (*Pristis*, *Pristis zijsron*, *Pristis clavata*, *Glyphis* and *Glyphis garricki*)
- Approved Conservation Advice for *Rhincodon typus* (whale shark)
- Recovery Plan for Marine Turtles in Australia.

The recovery plans, threat abatement plans and conservation advice present objectives and actions to aid the recovery or protect threatened and migratory species, been presented in Table 9-4, to determine if the Petroleum Activities Program is consistent with the relevant objective and actions detailed.

Table 9-4: Actions and objectives of the recovery plans, threat abatement plans and conservation advice and consistency of the Petroleum Activities Program

Plan	Threat	Objectives/Actions	Consistency of the Petroleum Activities Program with the Objective and Actions
Threat Abatement Plan for the Impacts of Marine Debris on the Vertebrate Wildlife of Australia's Coasts and Oceans	Marine Debris	The below outlines the objectives and actions relevant to the Petroleum Activities Program: • Contribute to long-term prevention of the incidence of marine debris. • Understand the scale of impacts from marine plastic and microplastic on key species, ecological communities and location. • Remove existing marine debris. • Monitor the quantities, origins, types and hazardous chemical contaminants of marine debris, and assess the effectiveness of management arrangements for reducing marine debris.	It is recognised that by leaving the infrastructure in situ to degrade over time, rather than remove it, increases the levels of plastics in the marine environment. However, a comparative assessment process (Section 4.538) and equal or better outcomes assessment (Section 4.6), which takes into account the impact on marine fauna from different decommissioning options, has been completed and identified the recommended option is to leave the Woollybutt infrastructure in situ. It is considered that the environmental risks in removing the infrastructure outweigh the impact from the release of marine plastics over time. The modelling conducted by Atteris (2021) quantified the breakdown of the plastic to aid the understanding of impact to marine fauna and showed a slow rate of plastic degradation and that the majority of plastics will remain buried in situ (60 to 90%). The severity of potential impacts on marine fauna has been assessed as minor (Section 9.3) The impact of the release of plastics from the infrastructure left in situ on marine fauna has been described in Section 9.3 Although plastics have potential to be released to the marine environment, the majority of plastics will remain buried in situ. The plastics that remain in situ will not have the potential to interact with marine fauna and other marine vertebrates as they will be buried. For the portion of plastics that are not expected to be buried, the rate of degradation is predicted to be very slow over 1,000 to 10,000 years. Therefore, it is unlikely plastics discharge is going to occur at quantities or rates that have potential to significantly impact marine fauna. Monitoring the release of contaminants and plastics from the infrastructure has been investigated in Section 9.3.4 and not adopted based on the outcome of an ALARP evaluation. Further management arrangements for reducing marine debris have been assessed in the comparative assessment process (Section 4.5). Given the above, the Petroleum Activities Program is not inconsistent with the objectives and actions of the Threat Abatement Plan for the Impacts of Marine Debris on the Vertebrate Wildlife of Australia's Coasts and Oceans.

Plan	Threat	Objectives/Actions	Consistency of the Petroleum Activities Program with the Objective and Actions
Recovery Plan for Marine Turtles in Australia		Reduce the impacts from marine debris, through the following actions relevant to the Petroleum Activities Program: • Describe and quantify the impact of ingestion of debris on marine turtles, particularly those life phases using the open ocean. • Support the implementation of the EPBC Act Threat Abatement Plan for the impacts of marine debris on vertebrate.	The marine debris/release of plastics from the infrastructure left in situ has been assessed through modelling conducted by Atteris, 2021, which provides a quantification of the breakdown of the plastic to aid the understanding of impact to marine fauna. The modelling identified the likely particle sizes from each component of the infrastructure as well as the expected dispersion of those particles over time (refer Table 9-3). The impact of the release of plastics from the infrastructure left in situ on marine turtles has been described in Section 9.3 This includes the pathways to impact on the marine environment (including those on marine turtles) from the release of plastic debris. The level consequence and residual risk of the release of plastics from the infrastructure left in situ has been quantified in Section 9.3. Given the slow rate of degradation and the that the majority of plastics will remain buried in situ (60 to 90%), the severity of potential impact on marine fauna is minor. It is recognised that by leaving the infrastructure in situ to degrade over time, it has the potential to increase the levels of plastics in the ocean. However, a comparative assessment process (Section 4.5) and equal or better outcomes assessment (Section 4.6), which takes into account the impact on marine fauna from different decommissioning options, has been completed. The recommended option is to leave the Woollybutt infrastructure in situ. The Petroleum Activities Program's consistency with the Threat Abatement Plan for the impacts of marine debris on vertebrate has been assessed above. Given the above, the Petroleum Activities Program is not inconsistent with the objectives and actions of the Recovery Plan for Marine Turtles in Australia.
Approved Conservation Advice for *Rhincodon typus* (whale shark)		N/A – Marine debris has been listed as a threat (less important).	The impact of the release of marine debris/plastics from the infrastructure left in situ on marine fauna has been described in Section 9.3. This includes the pathways to impact on the marine environment (including whale shark) from the release of plastic debris. The level consequence and residual risk of the release of plastics from the infrastructure left in situ has been quantified in Section 9.3. Given the slow rate of degradation and the fact the majority of plastics will remain buried in situ (60 to 90%), the severity of potential impact on marine fauna is minor.

Plan	Threat	Objectives/Actions	Consistency of the Petroleum Activities Program with the Objective and Actions
			It is recognised that by leaving the infrastructure in situ to degrade over time, it has the potential to increase the levels of plastics/marine debris in the marine environment. However, a comparative assessment process (Section 4.5) and equal or better outcomes assessment (Section 4.6), which takes into account the impact on marine fauna from different decommissioning options, has been completed. The recommended option is to leave the Woollybutt infrastructure in situ. Given the above, the Petroleum Activities Program is not inconsistent with the Approved Conservation Advice for *Rhincodon typus* (whale shark).
Sawfish and River Sharks Multispecies Recovery Plan: *Pristis*, *Pristis zijsron*, *Pristis clavata*, *Glyphis* and *Glyphis garricki*		Reduce and, where possible, eliminate any adverse impacts of marine debris on sawfish and river shark species. Assess the impacts of marine debris including plastics on sawfish and river shark species.	The level of consequence and residual risk of the release of plastics/marine debris from the infrastructure left in situ has been quantified in Section 9.3. Given the slow rate of degradation and the fact the majority of plastics will remain buried in situ (60 to 90%), the severity of potential impact on marine fauna is minor. It is recognised that leaving the infrastructure in-situ to degrade over time has the potential to increase levels of plastics/marine debris in the marine environment. However, a comparative assessment process (Section 4.5) and equal or better outcomes assessment (Section 4.6), which takes into account the impact on marine fauna from different decommissioning options, has been completed. The recommended option is to leave the Woollybutt infrastructure in situ. Given the above, the Petroleum Activities Program is not inconsistent with the Sawfish and River Sharks Multispecies Recovery Plan.

Marine Environment Quality

The release of plastics has potential to impact the marine environment through contamination of the water and/or sediments. As mentioned above, 33 chemicals have been identified as potential manufacturing additives or degradation products of the Woollybutt infrastructure; 16 of these have been found to be potentially harmful to the marine environment, including perfluorooctanoic acid, which is a persistent, bioaccumulative, toxic chemical (Atteris, 2021).

Chemicals enter the marine environment through leaching into the water or sediment. The frequency of leaching from infrastructure component depends on the degradation events and when they occur. For the infrastructure components that are buried, leaching is likely to be directly into the sediment. For more exposed plastics or plastics that break off and travel away from the infrastructure, leaching is likely to occur directly to the seawater. However, in both scenarios, any leaching is anticipated to be at a low rate. For leaching into seawater, there is also expected to be rapid dilution and dispersion of any leached chemicals. Furthermore, chemicals with high and very high toxicity rankings are only expected to occur in medium and low relative masses within the infrastructure; therefore, leaching of these chemicals at concentrations likely to cause impact is not expected.

Sediments and seawater will also become contaminated with microplastics and macroplastics. Heavier and buried microplastics and macroplastics will tend to accumulate in sediments. The microplastics and macroplastics in sediments will be as a result of degradation occurring and materials becoming buried, which will be limited to within the Operational Area, and will accumulate in a localised area over time. The less dense microplastics and macroplastics that enter the seawater have potential to be dispersed outside of the Operational Area and will slowly disperse in small quantities.

The severity of potential impacts to marine environment quality is expected to be minor, given the relatively small mass of plastics with potential to leach chemicals and the slow rate at which plastics leach or degrade into the marine environment. Sediments within the Operational Area do not support significant species or habitats and therefore impacts from small quantities of localised contamination are minor. Similarly, the slow rate at which chemicals or degraded plastics would enter the seawater is such that they will rapidly disperse and dilute, causing only minor impact.

Protected Areas

It is estimated that 10 to 40% of the plastics in the Woollybutt infrastructure could break off as macroplastics and disperse over a period of up to 10,000 years (Atteris, 2021). Macroplastics have potential to float in the water column and wash up on beaches or disperse through marine parks. The closest protected area to the Operational Area is the Barrow Island Marine Management Area and the Barrow Island Nature Reserve. Due to its proximity to the Operational Area, there is potential for plastic components to wash up in these areas. However, this would be in small quantities and occur gradually over long timeframes (Atteris, 2021).

Given the small quantities and slow rates of degradation, the severity of the impact on protected areas is minor.

Other marine users

During stakeholder consultation it was identified that marine waste from the breakdown of plastics is a concern for commercial fisheries. Specifically, WAFIC raised concerns from two perspectives:

- The potential for marine plastics to impact fish stocks
- The potential reputational damage from the perceived degradation of the marine environment in Western Australia.

In the short to medium term there are expected to be benefits to commercial fisheries as the infrastructure provides a hard substrate which supports commercially fished species. Specifically, fish habitat studies undertaken on behalf of EAL observed 19 species of commercially important fish along the Woollybutt pipelines at a density of 195 fish per 1 km of pipeline (McLean et al., 2021). The most common commercially important species included cardinal fish (*Apogonidae* spp.), Areolate grouper (*Epinephelus areolatus*) and various snapper species (*Lutjanius quinquelineatus, L. malabaricus, Lutjanus vitta*) (McLean et al., 2021).

In the long term (1,000-10,000 years) plastics are expected to enter the marine environment and have potential to interact with commercially targeted fish stocks. It is considered that, as with other marine fauna, the rate of plastics entering the marine environment will not cause enough plastic particles at any given time for there to be impacts to species that are targeted for commercial fishing (GESAMP, 2016 and Atteris, 2020). The assessment of impacts on marine fauna, above, provides more details on the expected pathways for interaction with marine fauna and the likelihood of impacts on marine fauna from the Petroleum Activities Program.

Modelling by Atteris predicts that 60-90% of infrastructure will self-bury over the next 30 years, therefore only the unburied potion of plastic will degrade slowly overtime and release to the marine environment. Based on the slow-release rate, it is predicted that impacts to marine environmental quality will be limited.

Through consultation with stakeholders EAL have provided details of the plastics degradation report to stakeholders with the intention of increasing the understanding of the actual impacts that are expected from plastics entering the marine environment. Section 7 of this EP provides full descriptions of stakeholder consultation that has occurred to date.

9.3.4 Environmental Performance Outcomes and Control Measures

No environmental performance outcomes (EPOs) or controls are applicable to the impact.

9.3.5 ALARP Demonstration

Type	Control/ management	Evaluation	Adoption?
Eliminate	Removal of subsea equipment	Section 4 determined that leaving the infrastructure in situ provides equal environmental outcomes compared to complete removal. Furthermore, infrastructure has the potential to provide a benefit due to the creation of a hard substrate habitat on a mostly featureless seabed predominantly comprised of soft sediment.	x
Substitute	N/A	N/A.	N/A
Engineering	N/A	N/A.	N/A
Isolation	N/A	N/A.	N/A
Administrative	Implement a monitoring program	Studies have shown the degradation of the subsea equipment will occur over a period of thousands of years (up to 1200 years for metals and 10,000 years for plastics), therefore the rate of change is predicted to be slow and unlikely to be easily detected over short to medium timeframes. Given the timeframe for breakdown of materials, ongoing monitoring is impractical.	x

9.3.6 Acceptability Demonstration

Demonstration of Acceptability	
Compliance with Legal Requirements/Laws/ Standards	The Petroleum Activities Program is in compliance with EPBC 2001/365 approval. Prior to permanently leaving any structure in-situ, EAL will obtain a Sea Dumping Permit in accordance with the requirements of the Sea Dumping Act.
Policy Compliance	EAL's HSE Statement objectives will be met.
Social Acceptability	Stakeholder consultation has been undertaken. Stakeholder concerns have been addresses in Sections 7 and 9.3.3.
Area Sensitivity/ Biodiversity	Plastics have the potential to degrade into micro plastics and be transported withing the water column. As up to 90% of infrastructure is anticipated to self-bury over time and plastics are expected to degrade slowly. Impacts are expected to be limited and longer term.
ESD Principles	The impact assessment presented throughout this EP demonstrates compliance with the principles of ESD.
ALARP	The residual risk has been demonstrated to be ALARP.

The impact is considered ALARP. This is on the basis the only control available to further reduce the impact is to fully remove the infrastructure from the marine environment, which has costs and impacts that are considered to outweigh the benefits; see Section 4.6 for the full assessment of the potential impacts associated with removing infrastructure.

The residual impact is considered acceptable. This is on the basis that the majority (60 to 90%) of plastics will remain buried within the Operational Area. The remainder of the plastics are expected to enter the marine environment; however, these will be at a rate and over a timescale that is not likely to impact species, marine environmental quality, protected areas or the interests of other marine users.

10 UNPLANNED EVENTS- LEAVING INFRASTRUCTURE IN-SITU

10.1 Interaction with Other Users (Risk ID 4)

10.1.1 Summary of Environmental Risk

Table 10-1: Subsea infrastructure

Hazard	Subsea Infrastructure Interaction with Other Users		
	Frequency	Severity	Risk
Residual Risk	B	1	L

10.1.2 Description of Hazard

The Petroleum Activities Program proposes to leave all infrastructure in situ on the seabed. The long-term physical presence of infrastructure on the seabed, presents the possibility of interactions with other marine users (commercial fishers, shipping and defence).

Equipment proposed for abandonment in this EP extends approximately 30 cm above the seabed with the exception of grout bags which are less than 1 m in height.

10.1.3 Potential Environmental Impact

Potential environmental impacts to other marine users include:

- Accidental interactions with commercial fisheries
- Accidental interactions with other marine users include commercial shipping and defence vessels

No recreational fishing is expected to occur in the Operational Area.

10.1.3.1 Accidental Interactions with Commercial Fisheries

The Operational Area coincides with a number of Commonwealth- and State-managed fisheries (see Section 6.3). However, low levels of fishing effort at the field location and surrounding area have been recorded, and/or a low number of fishing vessels are known to operate. The Pilbara Trawl Fishery Zone 1, which is over the Operational Area, has been closed since 1998 (DoF, 2014) (see Section 6.3.1). However, it is possible for Zone 1 to reopen to trawling in the medium to long term.

EAL have consulted with fishing industry bodies, WAFIC and individual fishing licence holders within the Pilbara Trawl Fishery (see Section 7). During consultation WAFIC identified that the Woollybutt Infrastructure was considered to pose a long-term risk of snagging for commercial fishers. No other stakeholders raised concerns regarding the risk of snagging on infrastructure. However, EAL have considered the concerns raised by WAFIC and have undertaken a risk assessment of the potential for the Woollybutt Infrastructure to cause snag incidents in the future if Zone 1 of the Pilbara Trawl Fishery reopened.

EAL will notify the AHO of the infrastructure location so it will continue to be marked on navigational charts.

The Pilbara Trawl Fishery vessels are equipped with navigational equipment such as echo sounders and Geographical Positioning System (GPS) plotters, which enables them to detect and avoid infrastructure on the seabed (DPIRD pers comm).

A review of 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, shows there were no reported fishing vessel incidents related to offshore oil and gas infrastructure in Australia.

Outside of Australia, historically, wellheads are recorded to have caused fewer snag incidents in commercial fisheries, compared to pipelines and marine debris from oil and gas operations, which accounted for more than 50% of incidents in the UK between 1989 and 2016 (Rouse, 2020). In comparison, production infrastructure, which includes wellheads, were involved in 4% of incidents over the same period (Rouse, 2020). Overall, the likelihood of interactions between trawl equipment and oil and gas infrastructure is reducing over time, as a result of an increase in communication between the oil and gas industry and improvement in fishery GPS equipment (Rouse, 2020).

In the unlikely event of snagging, potential consequences are financial loss to commercial fishers either through lost fishing time or damages to, and losses of, fishing gear (Rouse, 2020). Studies of historical snag incidents in the UK have found that vessel damage or loss occurred less than 0.5% of the time, with one capsize resulting in fatalities/injuries occurring in the UK between 1989 and 2016 (Rouse, 2020), equating to 0.06% of incidents.

Based on the navigational equipment on board the vessels, historical information on vessel incidents related to oil and gas infrastructure in Australia and likely improvements in GPS fishing equipment in the future, the risk of trawl net snagging is low.

10.1.3.2 Accidental Interactions with Other Marine Users (not fisheries)

Vessel traffic is relatively light within the Operational Area, with the exception of the southern region. AIS data indicates a number of tankers transit through this area, most likely on their way into and out of the ports of Ashburton and Onslow (see Section 6.3.3).

The infrastructure left on the seabed is not expected to interact with shipping, given the water depth of the Operational Area. This has been confirmed by consultation with AMSA who raised no comments or concerns during consultation.

The Operational Area is located within a Defence practice area (refer to Section 6.3.4). The Department of Defence has confirmed operations would not interact with infrastructure left in situ.

10.1.4 Environmental Performance Outcomes and Control Measures

EPOs relating to this risk include:

- Information is provided to regulatory authorities and marine users directly affected by planned activities (EPO-1)
- No unplanned interactions with other users (EPO-2).

Control Measures relating to this risk include:

- Navigation equipment and procedures (CM-1).

Environmental performance standards and measurement criteria relating to the above are presented in Section 11.

10.1.5 ALARP Demonstration

Type	Control/ management	Evaluation	Adoption ?
Eliminate	Removal of subsea equipment	Costs of removing subsea infrastructure outweighs the benefits. Furthermore, infrastructure has benefits to commercial fishing through providing benthic habitat.	x
Substitute	N/A	N/A.	N/A
Engineering	N/A	N/A.	N/A
Isolation	The Australian Hydrographic Office notifications	Minor administrative costs in notifying AHO. Provides AHO with the ability to add infrastructure to navigation charts that will allow other sea users to identify where the infrastructure is located.	✓
Administrative	PSZ	The cost to other marine users from being permanent excluded from the area would outweigh the benefits, particularly given the depth of the infrastructure and the fact that it is no longer operational.	x

10.1.6 Acceptability Demonstration

Demonstration of Acceptability	
Compliance with Legal Requirements/Laws/ Standards	The Petroleum Activities Program is in compliance with EPBC 2001/365 approval. Prior to permanently leaving any structure in-situ, EAL will obtain a Sea Dumping Permit in accordance with the requirements of the Sea Dumping Act.
Policy Compliance	EAL's HSE Statement objectives will be met.

Demonstration of Acceptability	
Social Acceptability	WAFIC raised concerns regarding the physical presence of the infrastructure and snag risk. EAL responded to stakeholder concerned by adopting controls such as notifying the AHO of the infrastructure location and assessing the likelihood of snagging on infrastructure. A summary of consultation undertaken is outlined in Section 7. No further concerns have been raised by stakeholders.
Area Sensitivity/ Biodiversity	Fishing levels are low in the area and no major shipping routes coincide with the area. No known tourism occurs in the area. The Operational Area is located within a defence practice area. The Department of Defence has confirmed that operations would not affect the proposed field management activities or impact on the field.
ESD Principles	The impact assessment presented throughout this EP demonstrates compliance with the principles of ESD.
ALARP	The residual risk has been demonstrated to be ALARP.

The subsea infrastructure is located at depths where it is unlikely to interfere with vessels transiting the area or defence activities. WAFIC have raised concerns with regard to the physical presence of infrastructure and potential snag risk. Based on the navigational equipment on board the vessels, historical information on vessel incidents related to oil and gas infrastructure in Australia and likely improvements in GPS fishing equipment in the future, the risk of trawl net snagging is low.

To continue to provide marine users with adequate information on the location of the infrastructure, the AHO will be notified so infrastructure can be marked on navigational charts. This will bring the residual risk to ALARP. Furthermore, Rouse (2020) identifies that marking infrastructure on navigational charts and communication of the location of oil and gas infrastructure to commercial fishers can be attributed to a decrease in historic snag incidents over time and is therefore considered an effective control.

The residual impacts are also considered acceptable, given the depth of the infrastructure and the low volume of shipping traffic, fishing and tourism in the Operational Area. Potential impacts associated with interaction with other marine users are slight. Furthermore, the residual risk is considered low, which is acceptable in accordance with EAL's acceptability criteria (Table 8-4).

11 ENVIRONMENTAL OUTCOMES, STANDARDS AND MEASUREMENT CRITERIA

Regulation 13(7) of the OPGGS(E) Regulations require an EP to include EPOs, environmental performance standards and measurement criteria that:

- Address legislative and other controls that manage environmental features of the activity
- Define objectives and set standards for measuring EAL's performance in protecting the environment during its operations
- Include measurement criteria for assessing whether performance outcomes and standards have been met.

The terms used for measuring the environmental performance are defined below:

- Performance outcome – a statement of the goal EAL aims to achieve with regard to the management of a given hazard.
- Performance standard – a statement of performance required of a system, an item of equipment, a person or a procedure that is used as a basis for managing environmental risk. Generally, a number of standards may relate to a single objective.
- Measurement criteria – defines how the application of the performance standard will be verified. Several measurement criteria may relate to a single performance standard. Measurement criteria are defined in a manner that enables efficient inspection and/or audit against the performance outcomes and allows for an audit trail.

To ensure environmental risks and impacts will be of an acceptable level, EPOs have been defined and are listed in Table 11-1. These outcomes will be achieved by implementing the identified control measures to the defined performance standards.

Table 11-1: Environmental performance outcomes

Reference	Environmental Performance Outcomes
EPO-1	Information is provided to regulatory authorities and marine users directly affected by planned activities
EPO-2	No unplanned interactions with other marine users

11.1 Control Measures and Performance Standards

The control measures that will be used to manage identified environmental impacts and risks, and the associated statements of performance required of the control measure (i.e., environmental performance standards), are listed in Table 11-2. Measurement criteria outlining how compliance with the control measure, and the expected environmental performance, could be evidenced are also listed.

Table 11-2: Control measures and environmental performance standards

EPO References	Control Measure (CM)	Environmental Performance Standards (EPS)	Measurement criteria (MC)	Risk ID
EPO-1 **EPO-2**	**CM-1** Navigation equipment and procedures	**EPS-1.1.** EAL will notify relevant State and Commonwealth fisheries that the infrastructure will remain in-situ.	**MC-1.1.** Records show State and Commonwealth fisheries are notified of the location of infrastructure and that infrastructure will remain in-situ.	**4**
	CM-2 Navigation charts	**EPS-2.1.** Eni will notify AHO to ensure infrastructure left in-situ is marked on nautical charts.	**MC-2.1.** Records show AHO is notified and infrastructure left in-situ is marked on nautical charts.	**4**

12 IMPLEMENTATION STRATEGY

The purpose of the implementation strategy section is to manage the activities and their associated environmental risks to ALARP and ensure environmental performance is monitored. Regulation 14(1) of the OPGGS(E) Regulations requires that the EP contain an implementation strategy. To meet this Regulation, this section:

- Describes the environmental management system for the activity, including specific measures to be used to ensure that, for the duration of the activity:
  - The environmental impacts and risks of the activity continue to be identified and reduced to a level that is ALARP
  - Control measures detailed in the EP are effective in reducing the environmental impacts and risks of the activity to ALARP and an acceptable level
  - EPOs and standards set out in the EP are being met. (Regulation 14[3]).
- Establishes a clear chain of command and the setting out of roles and responsibilities of personnel responsible for the implementation, management and review of the EP (Regulation 14[4])
- Presents measures to ensure all personnel directly undertaking works or associated works related to the activity have the appropriate competencies and training and are aware of their responsibilities under this EP (Regulation 14[5])
- Provides sufficient monitoring, recording, audit, management of non-conformance and review of the titleholder's environmental performance and the implementation strategy to ensure the EPOs and standards in the EP are being met (Regulation 14[6])
- Provides for sufficient monitoring of, and maintaining a quantitative record of, emissions and discharges (whether occurring during normal operations or otherwise), such that the record can be used to assess whether the EPOs and standards in the EP are being met (Regulation 14[7])
- Includes a process for maintaining an Oil Pollution Emergency Plan (Regulation 14[8]).

This section presents the implementation strategy for the Petroleum Activities Program.

12.1 Systems, Practices and Procedures

12.1.1 HSE Management System Overview

EAL's management of HSE matters is arranged hierarchically in two distinct levels:

1. Corporate level Management System
2. Subsidiary (Eni Australia) level HSE Integrated Management System (HSE IMS).

Within Eni, HSE management is delivered at the regional and asset level through the Eni HSE IMS, the means by which all HSE hazards and risks are controlled. The HSE IMS refers to the totality of Eni 's management systems in terms of the:

- Concepts, policies, strategies, HSE goals, processes, procedures and work instructions that comprise the formal content of the HSE IMS
- Organisational structures, communication systems, safety-related data, roles and responsibilities, competencies and training needed by the personnel to implement the HSE IMS
- Physical elements that are critical to safety (equipment, structures and engineered systems), including the codes and standards used to design and construct them.

This section describes Eni's HSE IMS from the corporate level through to implementation.

12.1.2 EAL Corporate Management System Guidelines

EAL adopts the guidelines provided by its corporate parent, Eni Upstream, which issued a *Divisional Directive for the development of Management System Guideline* – HSE (MSG-HSE-ENI-SPA-eng). This section provides structure and guidance notes for Safety Management System development based on the five main elements and 18 sub-elements of the system shown in Figure 12-1.

These elements are largely based on the structure of ISO 14001 and OSHAS 18001 series of standards and therefore provide a consistent and recognisable platform for managing safety, while also ensuring the intent of the principle of continuous improvement is followed.

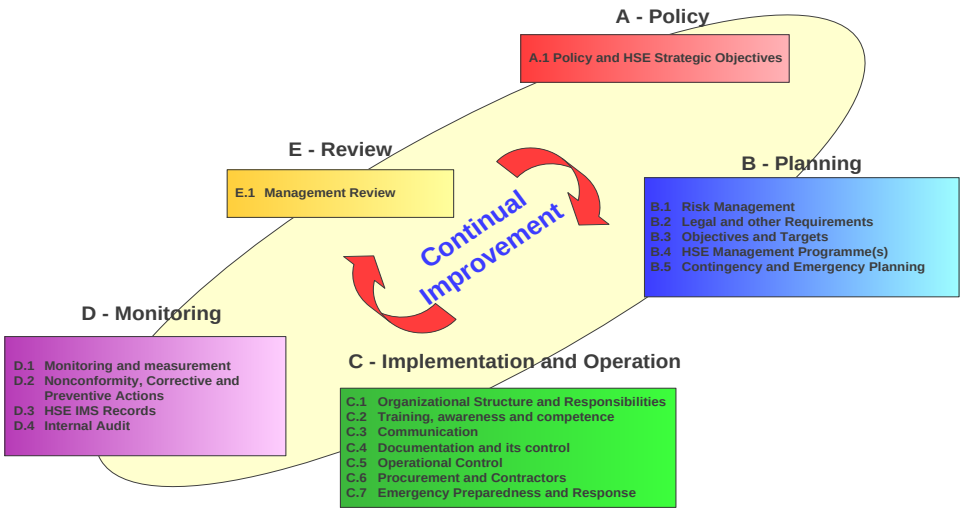

Figure 12-1: Eni HSE IMS five elements

12.1.3 Eni Australia Health, Safety and Environment Integrated Management System

The EAL HSE IMS, which covers Woollybutt field management and decommissioning activities, has been certified against the standards of:

- ISO 14001: Environmental Management System
- OHSAS 18001: Occupational Health and Safety Management System

- AS/NZS 4801: Occupational Health and Safety Management System.

In addition, the system uses the guidelines of ISO 17776 in its overall risk assessment approach.

Audits are performed to verify conformance with these standards and the Eni Upstream Corporate Directive.

The current HSE IMS structure is illustrated in Figure 12-2 and shows the interface between EAL's HSE IMS and the asset-level management system. Note that the structure provided is for guidance only and is subject to change.

The HSE IMS Framework Document (ENI-HSE-IN-002) serves as the key reference for EAL's HSE IMS and is an information source for EAL employees and contractors.

The HSE IMS Framework Document provides an overview of the strategies that are used to manage HSE aspects of EAL's operations, including emergency response, risk and security, and ensure their continual improvement in line with established objectives and targets. This document also describes the core elements of the HSE IMS and their interaction with related documentation.

The HSE IMS Framework Document sets out functional requirements for HSE management. EAL has developed supporting documents that provide standards, processes, guidelines and criteria and information by which the functional requirements can be met. The documents are generally classified as either information, standards, procedures or specification documents.

The HSE Standards cover a broad range of high-risk activities and outline EAL's minimum requirements and expectations across its operations. The HSE Standards complement the EAL HSE Golden Rules and are based on worldwide International Oil and Gas Producers Association and Company best practices.

The HSE Standards apply to all personnel working on EAL sites, whether they are an employee, contractor or visitor. The Standards apply to activities where EAL has direct operational control but also apply to activities where EAL has a prevailing influence over the performance of its contractors and suppliers.

The HSE IMS Framework document also describes how occupational health and safety are managed by EAL in a style promoted by a philosophy of objective or risk-based regulation and continuous improvement.

At the apex of the system is EAL's HSE Statement (Appendix A). The statement is approved by the Managing Director and provides a public statement of EAL's commitment to the environment and improving environmental performance.

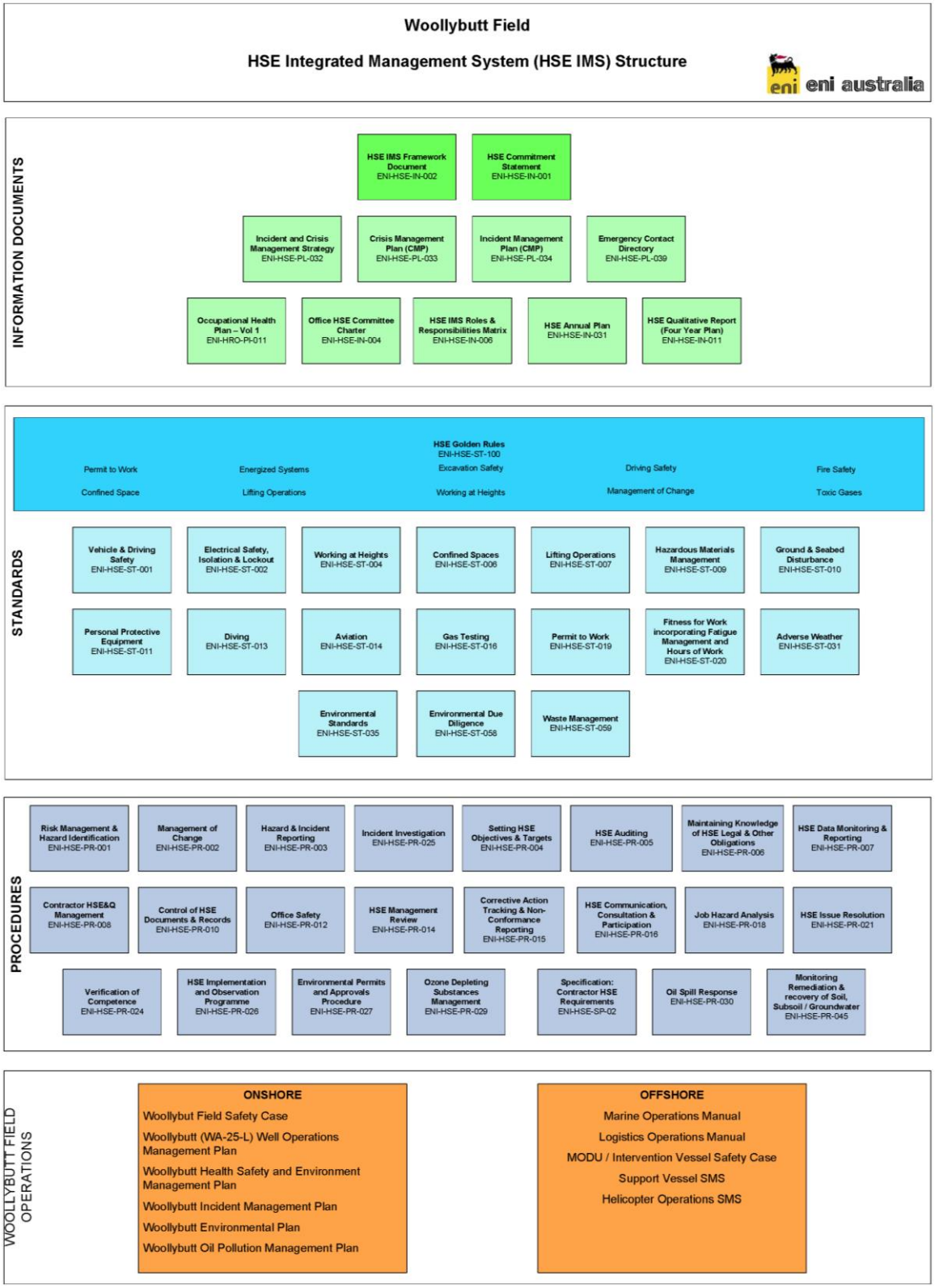

Figure 12-2: EAL HSE IMS structure

12.2 Roles and Responsibilities

Figure 12-3 presents the overall organisational structure in place for Woollybutt Operations and project roles. Table 12-1 summarises key roles and responsibilities personnel and contractors for implementing Woollybutt Petroleum Activities Program.

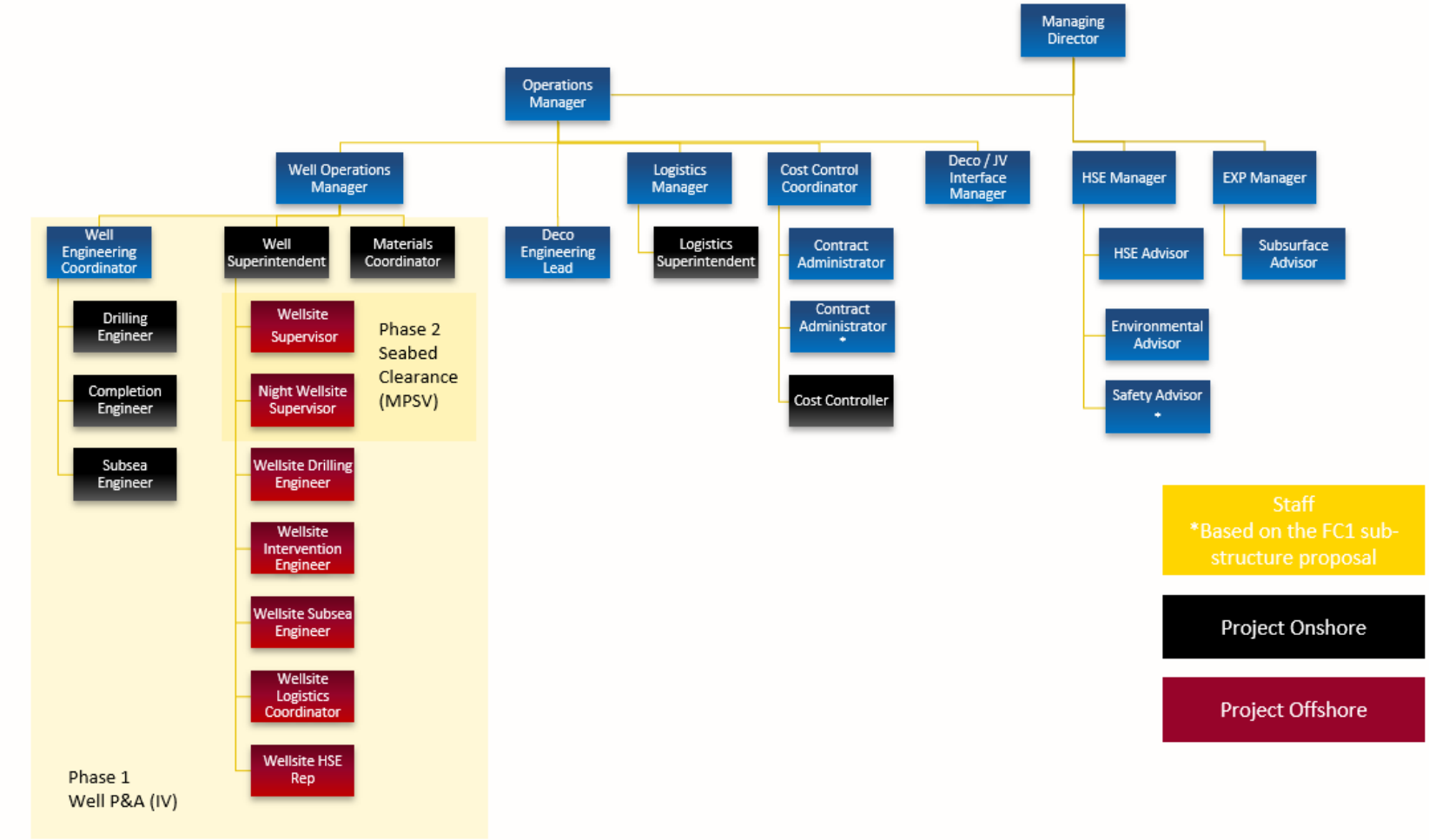

Figure 12-3: Woollybutt Eni operations organisation and proposed project roles

Table 12-1: Key roles and responsibilities for HSE management

Role	Responsibilities
Onshore personnel	
Managing Director	Overall responsibility for HSE and ensuring resources are available to effectively implement this EP. Approving this EP and confirming that all significant environmental risks have been identified and that mitigation strategies will be implemented.
Operations Manager (office-based)	Implementing the HSE IMS within the operational area, by the application of the EP. Approving this EP and confirming that all significant environmental risks have been identified and that mitigation strategies will be implemented. Allocating personnel with the relevant competencies to specific roles in accordance with the EAL organisation chart and position descriptions. Assisting the IMT/CMT in the event of an emergency. Ensuring Notice to Mariners are issued and maintained. Notifying NOPSEMA of the details of reportable incidents and providing updates on the status of the incident (Section 12.8).
Decommissioning Lead (office based)	Reviewing this EP and confirming all environmental risks have been identified, mitigation strategies are effective and will be undertaken during decommissioning monitoring activities, including emergencies or potential emergencies. Ensuring: • Compliance with all environmental regulations and the EP • That the requirements of the EP are communicated to Third Party contractors • All personnel are inducted and are aware of their environmental responsibilities • Environmental audits are undertaken on support vessels to verify compliance with the EP • All equipment is maintained and in an operable condition • Actions are tracked in an action register, implemented and closed out, including corrective actions identified during audits • Waste is managed on all vessels according to this EP. Reporting all environmental incidents to the Operations Manager, HSE and CSR Manager and IMT Leader.
HSE Manager (office-based)	Reviewing this EP and confirming that all environmental risks have been identified, mitigation strategies are effective and will be undertaken during activities, including emergencies or potential emergencies. Providing and maintaining effective emergency response arrangements for project activities where there is potential environmental risk. Performing incident investigations. Submission of annual environmental compliance report to NOPSEMA.
Senior Environmental Advisor (office-based)	Reviewing HSE Management Plans for acceptability and ensuring compliance with this EP.

Role	Responsibilities
	Reporting all incidents to NOPSEMA in accordance with Section 12.8. Coordinating and reviewing environmental audits to ensure compliance with the agreed EPOs. Providing advice in the event of an oil spill or other environmental incident.
HSE Assurance Advisor	NOPSEMA monthly environment reporting of 'recordable incidents'.
EAL IMT Leader	Directing the EAL response in the event of an incident. Notifying NOPSEMA of the details of reportable incidents and providing updates on the status of the incident Notifying AMSA in the case of vessel incidents. Communicating with IMT/CMT, government, stakeholders and media in the event of an incident.
EAL IMT Duty Officer	Acting as the first point of contact in an incident. Notifying the EAL IMT Leader of the incident.

12.3 Training

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

12.4 Competency

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

12.5 Monitoring

No ongoing monitoring has been proposed under this EP, as the rate of degradation is sufficiently slow that water or sediment sampling is unlikely to detect any impacts in the environment, and it is not feasible or practical to implement a monitoring program that spans a similar timeframe. However, post-decommissioning monitoring is included in the scope of the Field Management EP.

Decommissioning monitoring within the scope of the Field Management EP includes visual inspection of the seabed and remaining equipment by ROV and sediment quality monitoring. The monitoring is expected to be undertaken at the completion of the equipment removal campaign covered by the Field Management EP.

12.6 Auditing and Inspection

No ongoing auditing or inspections have been proposed under this EP, given there are no planned activities beyond acceptance of this EP.

12.7 Non-Conformance, Corrective and Preventative Actions

No ongoing management of non-conformances is proposed under this EP, given there are no planned activities beyond acceptance of this EP.

12.8 External Reporting

12.8.1 Routine Woollybutt Reporting

Routine regulatory reporting requirements for the Woollybutt Petroleum Activities Program are summarised in Table 12-2. The requirements include that EAL develops and submits an annual Environmental Performance Report to NOPSEMA, with the first report submitted within 12 months of the commencement of activities covered by this EP (as per the requirements of Regulation 14(2) (b)).

Table 12-2: Routine Woollybutt external reporting requirements

Report	Recipient	Frequency	Content
Monthly summary of recordable incidents	NOPSEMA	Monthly, by 15th of the following month.	Summary of recordable environment incidents. Reporting period is per calendar month.
End-of-activity EP Performance Report	NOPSEMA	Within three months of EP completion.	Submit to NOPSEMA within three months of EP completion.

12.8.2 Incident Reporting (Reportable and Recordable)

12.8.2.1 Reportable Incidents

Under OPGGS(E) Regulation 16(c), 26 and 26A – Reportable Incident, NOPSEMA must be notified of any reportable incidents. For the purposes of Regulation 16(c), a reportable incident is defined as an incident relating to the activity that has caused, or has the potential to cause, moderate to significant environmental damage.

For the Petroleum Activities Program, a reportable incident includes:

- Oil spills of more than 80 L in Commonwealth waters
- An incident that has caused or has the potential to cause environmental damage with a consequence level of Local (3) or above (Table 8-2).

There are not expected to be any reportable incidents under this EP as no activities are planned beyond acceptance of the EP.

12.8.2.2 Recordable Incidents

Under the OPGGS Act, a "recordable incident" for an operator of an activity is "a breach of an environmental performance outcome or standard that applies to the activity and is not a reportable incident".

There are not expected to be any recordable incidents under this EP as no activities are planned beyond acceptance of the EP.

12.9 Internal Reporting

All environmental incidents, deviations from this EP, or events that do not meet the EPOs of the EP will be recorded and reported to EAL, using the EAL Procedure *Hazard and Incident Reporting and Investigation* (ENI-HSE-PR-003). This includes entering the incident into the incident tracking database, accessible by contractor supervisors and EAL personnel.

12.10 Knowledge-Sharing and Health, Safety and Environment Communication

HSE communications include both internal communication to employees and external communication to stakeholders and is managed in accordance with ENI-HSE-PR-016 procedure *HSE Communications, Consultation and Participation*. Emergency Communications are described in the Emergency Response Plan (000036_DV_PR.HSE.0675.000). HSE commitments and obligations are established, recorded, maintained, communicated and managed within EAL in accordance with ENI-HSE-PR-006 procedure *Maintaining Knowledge of HSE Commitments and Obligations*.

12.10.1 Internal Communications with Eni Upstream Division

Regular communications from the Eni Upstream Division regarding HSE matters include:

- Guidelines for the establishment of annual HSE objectives
- Requests of monthly, quarterly and annual reports
- Documentation relevant to the establishment of budgetary provisions for HSE activities
- Highlighted actions to improve certain objectives
- Reports on HSE audits that may have taken place
- Incident reporting and investigation and lessons learnt
- Publication of HSE articles in the Company's publications
- Distribution of the Policy, Procedures and other documents of the HSE Management System
- Publication of Eni's annual Sustainability Report
- Any other communication specific to a particular HSE event.

EAL regularly communicates HSE performance information to Eni's Upstream Division via:

- Monthly, quarterly and annual reports
- Accident/incident reports and investigation
- Audit and Corrective Action close out status
- HSE Qualitative Report (Four Year Plan) (ENI-HSE-RP-011) and HSE Annual Plan (ENI-HSE-PL-031).

12.10.2 Internal Eni Australia Communications

Typical examples of key internal communication are:

- Weekly Management Meetings
- Activity Morning Calls
- Back-to-back Roster Handovers
- HSE Meetings
- Pre-start Meetings
- Safety Initiatives and Communications
- Management Safety Visits.

12.10.3 Non-Verbal Communication

In addition to the meetings described above there are a number of non-verbal means of communicating HSE issues within EAL, including:

- EAL intranet websites
- Emails
- HSE noticeboards.

The EAL Intranet site has an HSE page which contains links to:

- HSE IMS
- Reporting forms
- Incident and crisis management documentation
- Woollybutt Safety Case documentation
- Woollybutt Decommissioning Environmental Plan.

Emails are regularly used to communicate HSE issues with EAL. Typically, these would be:

- HSE Alerts. HSE Alerts are specific alert notices that arise from Hazard and Incident Reports, and are typically only considered for high potential incidents. The HSE Manager will decide on whether to issue an HSE Alert to inform the wider workforce.
- HSE Bulletins. Notices on HSE topics that need to be raised in the workforce can be done so using HSE Bulletins. They can focus on an HSE theme or just raise a specific item of interest. The HSE Manager coordinates the development of new HSE Bulletins.

HSE Noticeboards are present in all EAL offices and plants. They function to inform the workforce about HSE issues. Regular items which are placed on the HSE noticeboards include:

- HSE Commitment Statement
- incident statistics

- Incident Descriptions
- Audit reports
- Hazard Cards (for reporting hazards).

12.10.4 External Communications

External communication on HSE matters is typically made to a range of recipients including Governments (including government agencies and regulators), community groups, NGOs, customers, industry bodies, and the media (Table 12-3).

Table 12-3: External communication summary

External communication	Details on communication level
Government	EAL's HSE communications with government authorities is undertaken according to legislative requirements and guidelines, or where none exist, best practice. Generally, HSE communications between EAL and relevant government departments are carried out through the EAL Operations and HSE Departments. Records of key communications are maintained by the EAL relevant Department. The Managing Director may address communications with government bodies in certain circumstances (e.g. major accident investigation), in which case Eni upstream may also become involved.
Non-Government Organisations and Community Groups	HSE communication and consultation with NGOs and Community Groups will generally be coordinated by the HSE Department. Technical HSE communications to NGOs and Community Groups may be handled via an HSE specialist assigned to the particular project. Technical HSE communications may be undertaken by an HSE specialist.
Customers	EAL actively engages with its customers, to ensure there is a common understanding of HSE issues as they are related to the supply of products. HSE communication with customers will generally be coordinated by the relevant department(s) with advice from the HSE Department.
Business and Industry Organisations	EAL is a member of the APPEA and the WA and NT Chambers of Commerce. Interaction with the business community also occurs in EAL's day to day business. Industry forums, such as the APPEA conferences and South East Asian and Australian Offshore Conference (SEAAOC) allow EAL to further communicate HSE aspects. HSE communication with Unions is coordinated by the Human Resources Department with advice from the HSE Department.
Media	Media liaison in relation to crisis and emergency situations are managed in accordance with the EAL Crisis Management Plan.
Public HSE Reporting	EAL, through its corporate head company Eni Upstream, communicates externally to the public about EAL's significant HSE aspects through a public Sustainability Report. This report contains information on the HSE performance of Eni Divisions and Business Units, including EAL. The Sustainability Report enables Eni to share its vision and commitment to sustainable

External communication	Details on communication level
	development with its staff, all relevant stakeholders and the public. It is available on the Eni internet site (www.eni.it).

12.11 Management Review and Improvement

The HSE IMS is reviewed on a minimum five-yearly basis in association with risk assessment outcome and incident reviews for required changes. This review includes the review of any triggers requiring update to the HSE IMS (as detailed below), as well as general business planning outcomes and assessments of the effectiveness of performance standards. The review also documents actions and requirements for items, including the review and update of procedures and systems as identified in the HSE IMS review.

The HSE IMS review also incorporates feedback from the public and Regulators with respect to performance and expectations.

The changes that may initiate review of the HSE IMS include:

- Legislative changes, including changes to the regulatory regime (such as modification to Pipeline Licence conditions)
- Advancement in technology
- Significant changes arising from hazard/event investigations to prevent recurrence
- Significant changes due to complaints and changing community expectations
- Significant changes/improvements identified from various risk assessments, including ongoing hazards and operability, hazard identifications, job hazard analyses and other hazard identification processes
- Significant changes in activities (methodology in work processes)
- Significant changes in organisation structure, business policies and objectives
- Significant changes resulting from monitoring HSE key performance indicators
- Remedial actions from audits.

12.11.1 HSE Management Review

A formal management review is conducted yearly to assess overall implementation of the HSE IMS as per the procedure *HSE Management Review* (ENI-HSE-PR-014). Areas in need of reinforcement are identified and as a result the elements of the system that need to be reinforced are highlighted. Action plans and responsibilities are agreed to improve risk management and the overall HSE performance of EAL.

This includes reviews of the:

- Changes in:
    - External and internal issues that are relevant to the environmental management system

  - The needs and expectations of interested parties, including compliance obligations
  - Significant environmental aspects
  - Risks and opportunities.
- Information on environmental performance, including trends in:
  - Non-conformities and corrective actions
  - Monitoring and measurement results
  - Fulfilment of compliance obligations
  - Audit results.
- Adequacy of resources
- Relevant communication(s) from interested parties, including complaints
- Opportunities for continual improvement
- Changes in legislation or guidance (such as current requirements for Australian marine parks)
- Advances in relevant environmental technology and new scientific information.

12.11.2 Continuous Improvement

Continuous environmental improvement of performance within EAL is driven by a number of mechanisms, which include:

- Corporate initiatives
- Auditing (see Section 12.6)
- Hazard and incident reporting (see Section 0 and Section 12.7)
- Incident investigation (see Section 12.7)
- HSE data monitoring and reporting (see Section 12.5).

Reporting of incidents and the monitoring of this data draws Management's attention to trends resulting from potential weaknesses. Thorough investigation of incidents can be used to alert Management to system failures.

HSE auditing can uncover system failures before incidents occur. Auditing, reporting and monitoring can notify Management of a deficiency in the HSE IMS or of a problem with implementation of the HSE IMS.

EAL is responsible for implementing an ongoing process to identify and assess suitable measures for improving plant reliability and availability, plant safety levels and for reducing maintenance activities workload and material costs.

12.12 Management of Change and Reviews of this Environment Plan

Change is managed in accordance with the EAL *Management of Change* (MOC) *Procedure* [ENI-HSE-PR-002].

The *Management of Change Procedure* applies to changes in operational assets, systems, processes, operations, products, organisation and staffing that have the potential to alter hazard or risk levels, or affect environmental outcomes, including compliance with applicable laws or standards, or to significantly affect a stakeholder involved with the above items. Standard modifications or changes that occur within existing work processes (such as Permit to Work system) or are of a routine nature are not included in this procedure. Descriptions of changes where this procedure applies are listed in Table 12-4.

Table 12-4: Example of changes (HSE-critical) to which the MOC procedure applies

Type of change	Explanation
Changes to design or operating conditions	• Alteration to critical design or key assumptions operating data. • Change in composition and/or rate of feed or products. • Alternative type or manufacturer of workplace substances. • Operating outside design or manufacturer's recommendations.
Deviations from critical procedures	Deviations from: • Work Management Procedures • Critical Operating Procedures • Critical Maintenance Procedures.
Critical non-routine operations	Critical non-routine operations, with potential for significant risk (not covered by an existing critical procedure) managed with special preparation and procedures to ensure positive control.
Statutory-approved processes	Changes to operations, drilling or seismic programs approved through Safety Cases, EPs or Oil Spill Contingency Plans, or other statutory processes.
Changes in engineering	Where equipment being replaced is not 'like for like'. Design changes for improvements in equipment/process.
Major plant and equipment tests	Includes tests which could: • result in operating outside normal operating limits • adversely affect product quality • breach regulatory limits • require isolation of safety or shutdown systems • result in major equipment or plant shutdown • create an additional hazard or increase in risk • cause a change in risk profile.
Software changes	Permanent changes to alarm and shutdown settings. Permanent changes to control software, logic or configuration changes.
Systems changes	Changes to existing work systems and procedures that manage HSE risks or hazards.
People/organisation changes	Changes, introduction of removal of key personnel, work groups or functions within the business.

Potential changes in risk originating from external factors may lead to EP reviews. Changes which may lead to an EP review may include:

- Those concerning the scope of the activity description

- Advances in technology
- New scientific information
- Changes in understanding of the environment, such as advice on species protected under EPBC Act and current requirements for AMPs(Section 6)
- Potential new advice from external stakeholders (Section 7). These will be reviewed in regard to Regulation 17 of the OPGGS(E) Regulations.

External factors which may lead to EP review are identified through a number of means, including:

- Internal knowledge sharing and HSE communication (Section 12.10)
- Internal communications
- HSE Management Review (Section 12.11.1)
- Non-verbal communications
- external communications.

If a review of the activity and the environmental risks and impacts do not trigger a requirement for a revision, the change is considered minor. Minor change will be considered a 'minor revision', under Regulation 17 of the OPGGS(E) Regulations. Minor administrative changes to this EP, where an assessment of the environmental risks and impacts is not required (such as document references and phone numbers) will also be considered a 'minor revision'. Minor revisions will be tracked by EAL through its document change register on SharePoint and incorporated during internal reviews.

Management review (Section 12.11) may trigger a review of the EP and internal reviews will address matters such as the overall design and effectiveness of the EP, progress in environmental performance, changes in environmental risks, changes in business conditions, and any relevant emerging environmental issues or change in understanding of the environment (such as protected matters requirements). Reviews may also trigger adoption or reconsideration of once-rejected controls within the EP.

This EP will be revised and resubmitted to NOPSEMA:

- If/when an environmental inspection/audit (see Section 12.6) finds significant breaches of the EP requirements
- If any significant new environmental risk or effect, or significant increase in an existing environmental risk or effect, occurs that is not provided for in the existing EP as required by OPGGS(E) Regulation 17.

13 FINANCIAL ASSURANCE

EAL has calculated the level of Financial Assurance required for the activities described in this EP in accordance with the 2018 APPEA Method.

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APPENDICES

APPENDIX A:

ENI HEALTH, SAFETY AND ENVIRONMENT STATEMENT

health safety & environment statement

Eni Australia Ltd, in its natural resources and energy evolution activities is committed to providing a safe work place, safe systems of work, a competent workforce and a culture conducive to exercising prudent Health, Safety and Environment (HSE) practices and behaviours.

This commitment statement applies to all operational activities undertaken by Eni Australia Ltd, including activities carried out by our contractors.

Eni Australia Ltd will:

- Provide a safe and healthy workplace for the prevention of worker related injury and ill health.
- Set objectives and targets to ensure continual improvement in overall HSE performance.
- Comply with relevant legislation and other obligations, or apply company standards where laws and regulations do not exist.
- Assess and manage HSE risks across the business life cycle.
- Adopt high management and technical standards to prevent and mitigate major accidents associated with process safety events.
- Include HSE performance in appraisal of staff and contractors.
- Respect the environment and prevent pollution by actively monitoring and managing emissions, effluents, discharges and other impacts on the environment.
- Endeavour to reduce greenhouse gas emission intensity, fugitive emissions and process flaring as part of our climate strategy.
- Provide systems, resources and skills to maintain emergency response capabilities.
- Consult with stakeholders, local communities and public interest groups, workers and their representatives.
- Remain committed to sustainable development and the welfare of our host communities, and
- Promote HSE best practice in all our activities.

All staff and contractors at Eni Australia Ltd have a personal responsibility to support this HSE Statement and are encouraged to openly report any HSE issue or concern. In addition, everyone is obliged to intervene in unsafe acts or conditions to prevent injury, environmental impact or damage to assets.

Managing Director _____

Ernie Delfos

Date 10 August 2020

eni australia

APPENDIX B:

EXISTING ENVIRONMENT

Contents

1 DESCRIPTION OF THE ENVIRONMENT

This Appendix supplements Section 6 of the EP and describes the environment within the Operational Area (refer to Section 6.1 of the EP). It includes details of the relevant values and sensitivities of the environment as required by the Commonwealth Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2009 and State Western Australian Petroleum (Submerged Lands) (Environment) Regulations 2012.

Searches for protected species listed under the EPBC Act were undertaken in July 2021 for the Operational Area (refer to Section 1.6 of this Appendix) using the DoAWE Protected Matters Search Tool for the purpose of identifying matters of national environmental significance listed under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). This document is informed by this search. Descriptions of all fauna are provided, with a focus on protected species that are threatened and migratory.

1.1 Physical Environment

1.1.1 Climate

The climate of the NWMR is subtropical with moderate winters and very hot summers. Climate statistics provided in this section are derived from recordings at Barrow Island (between 1967 and 2000). Barrow Island is located approximately 40 km to the east of the Operational Area. Daily temperatures in summer (December to March) range from 24 °C to 35 °C. Winter (June to August) daily temperatures range from 17 °C to 26 °C (Figure 1-1) (BOM, 2017).

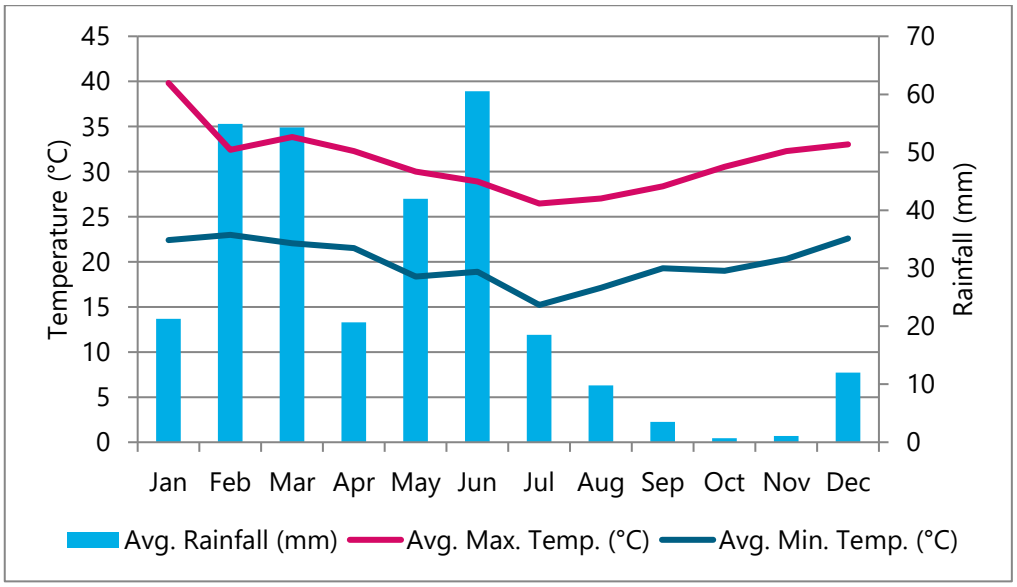


Figure 1-1: Mean monthly average maximum and minimum temperature and mean rainfall from 1967 to 2000 at Barrow Island (BOM 2017)

1.1.2 Rainfall

The region experiences low rainfall, with an annual average of 306 mm. The highest rainfall generally occurs from January to April, associated with tropical cyclones, and

then from May to June, associated with winter weather systems. On average, two tropical cyclones each year are expected to affect the Operational Area each year. However, this number is highly variable.

1.1.3 Wind Pattern

During October to March, winds are predominantly south-westerly or southerly in the morning, tending more westerly in the afternoon. The strongest prevailing winds are generally experienced between October and January, with wind speeds often ranging between 25 and 40 km/hr. During May to July, winds are mainly easterly, sometimes swinging southerly in the afternoon.

April is a transitional period when the winds are light and variable (mostly less than 20 km/hr). Wind direction is southerly or south-easterly in the morning, turning either north-easterly or south-westerly in the afternoon. August is the second transitional period of variable winds with directions generally southerly or south-easterly in the morning, with south-westerly or north-easterly winds in the afternoon. Hurricane-force winds associated with cyclones within the region can reach speeds of up to 240 km/h.

1.1.4 Bathymetry

The bathymetry of the NWMR is defined in four zones, each characterised by different water depths and geomorphic features. These zones include the inner continental shelf, middle continental shelf, the continental slope/outer shelf and the abyssal plain. Water depths range between 0 to 30 m within the inner continental shelf area, increasing from 30 to 120 m along the middle continental shelf. The continental slope/outer shelf area features depths greater than 120 m and gradients between 5 and 20 degrees representing a paleo-shoreline.

The water depth in the Operational Area is approximately 100 m. To the north-west, the water deepens gradually across the outer continental shelf before falling more steeply to form the continental slope. To the east, the seafloor shallows slowly before rising to form the shoals and islands that include Barrow Island and the Montebello Islands, located approximately 35 km and 65 km to the north-east respectively. Further east and to the south, the seafloor rises towards the shallow waters and shoreline of the Exmouth Peninsula and Pilbara Coast.

1.1.5 Oceanography

The major surface currents in the Region flow polewards, away from the equator. Their waters are warm, have low salinity and are oligotrophic (low in nutrients). The major surface currents influencing the Region include the Indonesian Throughflow, the Leeuwin Current, the South Equatorial Current and the Eastern Gyral Current (Figure 1-2). In addition, the Ningaloo Current, the Holloway Current, the Shark Bay Outflow and Capes Current are seasonal surface currents in the Region (Commonwealth of Australia, 2012). The effect of these currents is described in subsequent sections of this chapter.

Water circulation in the Northwest Shelf Province is highly seasonal. During winter, when the southern flow of the Throughflow is greatest, it dominates the water column. During summer when the Throughflow is weaker, strong winds from the southwest cause

intermittent reversals of the currents, which may be associated with occasional weak upwellings of colder, deeper water onto the shelf. The Ningaloo Current is also thought to intrude into the southern part of this bioregion during summer, flowing through the Operational Area towards the north as far as Barrow Island.

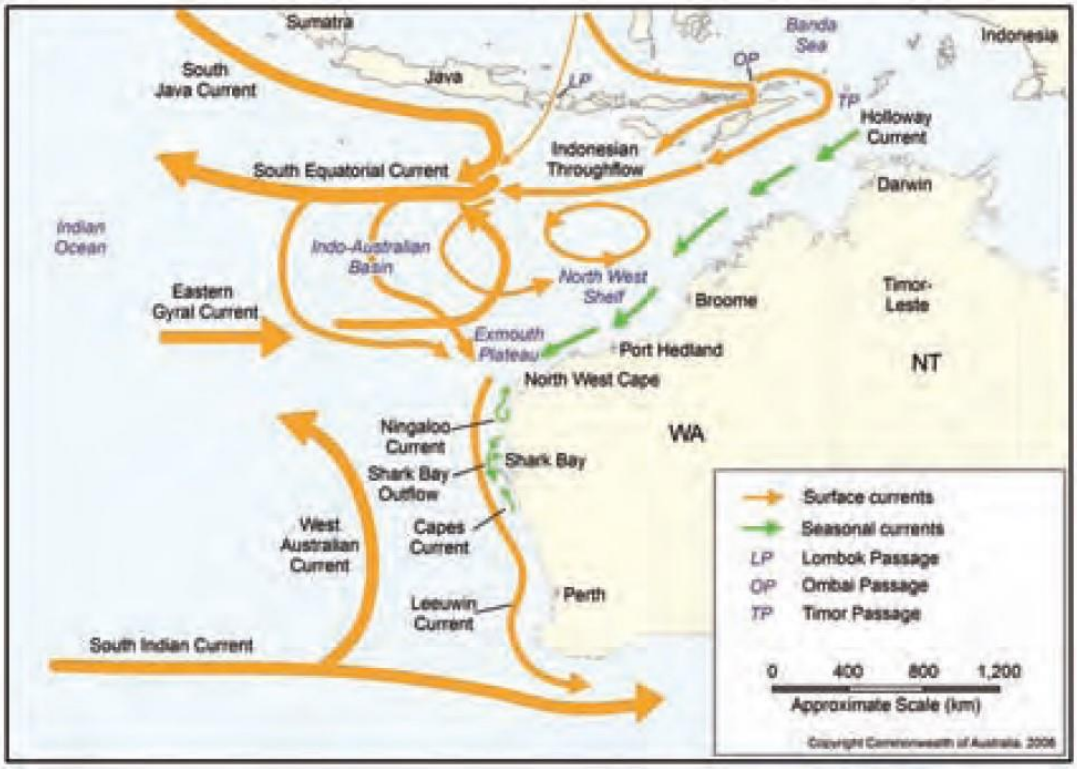


Figure 1-2: Surface currents in the North-West marine region

Tides are semi-diurnal with ranges of about 1 m on neap tides, increasing to 2.5 m on spring tides (AEL, 2010). Tidal movement is generally east-west at 0.1 m/s (AEL, 2010). In contrast to tidal currents, surface wind-driven currents range up to 0.8 m/s. Internal waves in the lower water column may have speeds of up to 0.7 m/s, and currents of up to 0.3 m/s can be encountered near the bottom.

Internal tides, although generated primarily around the shelf break, may have an influence in this bioregion as the crests of internal waves radiate onshore from the shelf break as far as the stratification of the water layer extends. When internal waves break they can cause mixing of more nutrient-rich water within the photic zone, which may in turn result in a burst of biological productivity.

Cyclones are another significant physical driver in this bioregion. The North West Shelf experiences an average of four cyclones each year, two of which make landfall. Cyclone-generated storm currents can cause significant sediment movement on the seafloor as well as vertical mixing of the water column. While cyclones can be very influential at the local scale, the overall contribution of cyclones to regional biological productivity is considered to be low.

Swell waves consistently propagate from the southwest, generated by distant storms (Chevron Australia, 2005), with heights of up to 2 m, rising to 3 m during the winter.

Extreme swell conditions of greater than 8 m can be encountered during cyclones. Short period waves (1–10 seconds) propagate from the southwest in summer and the east in winter at heights of less than 2 m, but this can increase and the direction change during storms. The largest seas (greater than 2 m) occur during winter (Chevron Australia, 2005).

Water temperatures in the vicinity of the field vary due to seasonal conditions and depth. Temperatures close to the sea surface range from 22°C to 31°C, typical of tropical waters in this region (Chevron Australia, 2005). Temperatures close to the seafloor will be lower.

The offshore waters in the vicinity the Operational Area are relatively clear. As with most of the waters off WA, the ocean in the region is oligotrophic, with very low nutrient and phytoplankton levels (Commonwealth of Australia, 2012). Turbidity increases in summer, mainly due to the increase in plankton load. However regional scale events, such as flooding associated with cyclonic rainfall, may cause occasional periods of increased turbidity.

1.1.6 Geomorphology and Geology

There have been four geophysical and ROV surveys in the Woollybutt Field undertaken in August 2001 (URS, 2001), June 2005 (Fugro, 2005), August 2014 (Neptune, 2014) and most recently in 2016.

The URS survey in 2001 showed that the seabed slopes gently down towards the west at a gradient of 1:1000 before dropping away more steeply beyond the western edge of the Operational Area. It also reports that the thickness of the surficial seafloor sediments varied between 0.9 and 5.1 m with approximately 85% of the area having a thickness of <4 m. This layer was interpreted as comprising soft to very soft very silts and fine sand, which are easily disturbed and pock marked by occasional burrows. The underlying layer was interpreted as comprising variably cemented sands or calcarenite.

1.2 Key Marine Habitats

1.2.1 Regional Overview

The outer continental shelf of the NWMR, where the OA is located, is predominantly flat and featureless and comprised of carbonate sands (Baker *et al*., 2008). Primary productivity in the Northwest Shelf Province is thought to occur predominantly in pelagic environments, where phytoplankton plays an important primary producer role, rapidly multiplying when nutrients become available. Although the region has generally low productivity, there are pockets of high species richness and diversity, in particular at the tropical reef sites, such as Ningaloo Reef and around Barrow Island and the Montebello Islands.

The marine habitat within the Operational Area mainly consists of soft sediment and epibenthic flora and fauna, as described below. The broader region, including areas within the OA, also contains a diverse range of other habitats, including, seagrasses, hard corals, mangroves, intertidal mudflats and sandflats, sandy beaches and rocky shores.

1.2.1.1 Benthic Communities

The Operational Area comprises of soft sediment habitat in deep water. Unconsolidated sediments support benthic fauna living both in the sediments (infauna) and on the surface (epifauna). In shallow areas soft sediments also support seagrass. However, there is no seagrass habitat in the Operational Area due to its depth. Predominant infauna species in soft sediment habitats are mobile burrowing species including molluscs, crustaceans (crabs, shrimps and smaller related species), polychaetes, sipunculid and platyhelminth worms, asteroids (sea stars), echinoids (sea urchins) and other small animals. Surface species include small crustaceans and molluscs, echinoderms and larger sessile organisms such as sponges, corals, sea whips and sea squirts (DEC, 2006).

1.2.1.2 Epibenthic Flora and Fauna

URS (2001) reports that biota on the seafloor of the Operational Area includes sponges, gorgonians (sea whips and sea fans), soft corals, crinoids (feather stars), ophiuroids (brittle stars), crustaceans (e.g. hermit crabs) and bryozoans (lace corals). The predominant infauna recovered from sediment samples were burrowing and tube-dwelling polychaete worms, brittle stars, gastropods and bivalves (molluscs) and amphipods (crustaceans).

Overall the density of sessile fauna was found to be low, with the larger organisms (feather stars, soft corals and fan corals estimated at occur at a density of approximately 1 per 10 m² for crinoids to 1 per 100 m² for soft corals and less for other species. Burrows, probably occupied by shrimp and gobioid fish, occurred more frequently, but patchily, with a density estimated at between 1 and 5 /m², while small worm tubes were more common.

Surveys undertaken at night showed a marked diurnal pattern in fauna, with small fish, shrimps, mantis shrimps and hermit crabs on or immediately above the seafloor. Larger fish were also more active in the late afternoon and night, as shown by the number of fish observed around the suspended Woollybutt WHs (URS, 2001).

The more recent survey in 2014 (Neptune, 2014) focussed on marine growth on the subsea infrastructure. Sparse to patchy coverage was found on the WB1A, WB2A and WB4 Xmas trees, consisting of hydroid/bryozoan turf, barnacles and encrusting sponges. Growth on SB1 was denser, consisting of moderate to dense coverage of hydroids and bryozoans and included barnacles, sponges and gorgonians (sea fans). The diversity of marine growth observed on or adjacent to the subsea flow-lines was similar across all locations with varying densities observed along the length of individual flow-lines. Marine growth was observed to occur on buried, partially buried and exposed sections of the subsea flow-lines. Growth observed on or adjacent to the subsea flow-lines of the Woollybutt Field included hydroids, bryozoans, soft corals, sponges, gorgonians (sea whips and sea fans), ascidians and other filter feeders.

Soft-bottom substrates, of the Operational Area are similar to those found in other areas of the NWMR such as the Joseph Bonaparte Gulf and along the Pilbara coast (Commonwealth of Australia, 2012).

1.2.1.3 Coral Reef

Across the NWS, corals tend to occur in relatively shallow areas with strong currents where water movement provides a constant supply of nutrients and particulate food. Hard (Order Scleractinia) and soft (Order Alcyonacea) corals are unlikely to be present within the Operational Area due to the water depth being too great to support zooxanthellae and a lack of hard substrate for coral recruitment.

Coral reefs are unlikely to occur within the Operational Area. The closest significant coral reefs to the Operational Area are found fringing the Barrow/Montebello Island groups, Muiron Islands and Ningaloo reef. Significant coral spawning occurs in autumn for a number of species, although some taxa such as Porites and Acropora spp. may spawn in spring and summer (Baird *et al*., 2011; Rosser and Gilmour, 2008). Mass spawning events have been observed along the Ningaloo Coast during March in the North and in April in the South (Gilmour *et* al., 2010).

Further information on sensitive locations with coral reef habitats is provided in Section 1.5.

1.2.1.4 Seagrass Beds and Macroalgae

Seagrasses typically grow in soft sediments in water depths between 2 m and 10 m where there is sufficient light to support photosynthesis. Seagrasses are important primary producers in tropical in-shore waters as they provide energy and nutrients for detrital grazing food webs. They are also directly grazed by protected animals such as dugongs and green turtles, and provide refuge areas for fishes and invertebrates (DEC, 2006).

Seagrasses do not occur within the Operational Area due to its water depth precluding light penetration to the sea floor. Suitable seagrass habitat is found around the Ningaloo coast where light reaching the seabed is sufficient for photosynthesis.

Macroalgae generally attach to hard substrates although some species such Caulerpa, Halimeda, Udotea and Penicillus can anchor in soft sediments or attach to shell fragments. Macroalgae are important primary producers and support diverse and abundant fauna of small invertebrates that are the principal food source for many in-shore fish species.

Macroalgae does not occur on the benthic substrate within the Operational Area, due to water depth and lack of hard substrate on which to attach.

1.2.1.5 Mangroves

Mangroves are productive coastal forest systems, providing habitat and shelter for infauna, epifauna and gastropods, and are important nursery areas for fish, lobster and prawn species. Mangroves may also provide shelter for other species such as juvenile turtles (DEC, 2007a). Ospreys (*Pandion haliaetus*) and white-bellied sea eagles (*Haliaeetus leucogaster*) roost in mangroves, while brahminy kites (*Haliastur indus*) and a range of smaller birds nest in them (DEC, 2007a). Mangroves are also recognised for their capacity to protect coastal areas from erosion due to storms and storm surge.

Mangrove communities in the NWS represent Australia's only 'tropical arid' mangroves (Pedretti and Paling, 2000). WA does not support any unusual, endemic or restricted mangrove species and all mangrove species within WA are common and widespread elsewhere in Australia or in the Indo-pacific region.

Mangroves do not occur in the Operational Area.

1.2.1.6 Sandy Beaches

Sandy beaches provide habitat for a variety of burrowing invertebrates and subsequently provide foraging areas for seabirds. Sandy beaches can also provide turtle nesting habitat, particularly at the Barrow/Montebello/ Lowendal islands and Ningaloo Coast (see Section 1.3.2).

Sandy beaches do not occur in the Operational Area.

1.2.1.7 Spawning, Nursery, Resting and Feeding Areas

Spawning, nursery, resting and feeding grounds are critical habitats for conservation and vary for each species. Biologically Important Areas (BIAs) have been designated for species occurring in the Operational Area.

1.2.1.8 Migration Corridors

Seasonal migration of cetaceans, whale sharks, seabirds, shorebirds and other marine species occurs through migration corridors for spawning, nursing and feeding purposes. Migration corridors for protected species passing within the Operational Area are detailed in Section 1.3.

1.2.1.9 Plankton

Plankton within the Operational Area is expected to reflect the conditions of the wider NWMR.

Phytoplankton is a source of primary productivity in the region and is largely driven by offshore influences. Periodic upwelling and cyclonic events drive coastal productivity and nutrient cyclin. Zooplankton in the region may include organisms which remain as plankton for their entire life cycle (e.g. copepods) in addition to larval stages of other taxa such as fish, coral and molluscs. Zooplankton biomass can peak at certain times of year through coral mass spawning events and fish spawning seasons.

1.3 Threatened and Migratory Species and ecological communities

1.3.1 Marine Mammals

Threatened and migratory marine mammal species within the Operational Area are listed in Section 6.2 of the EP. Details on the species identified are included below.

1.3.1.1 Blue Whale (Endangered/Migratory)

Two subspecies of blue whale are recorded in Australian waters; the southern (or true) blue whale (Balaenoptera musculus intermedia) and the pygmy blue whale

(Balaenoptera musculus brevicauda). Southern blue whales are believed to occur in waters south of 60°S and pygmy blue whales occur in waters north of 55°S (i.e. not in the Antarctic) (DEWHA, 2008). By this definition all blue whales in waters from Busselton to the Northern Territory 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). The Western Australian migration path takes pygmy blue whales down the Western Australian coast to coastal upwelling areas along southern Australia (*Gill, 2002*) and south at least as far as the Antarctic convergence zone (Gedamke *et al.*, 2007).

The northern migration passes the Perth Canyon from January to May and north bound animals have been detected off Exmouth and the Montebello Islands between April and August (Double *et al.*, 2012, *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).

A species recovery plan has been prepared for the blue whale which provides details of their distribution in Australian and potential threats, which include climate variability, noise interference and vessel disturbance (Commonwealth of Australia, 2015).

The BIA for pygmy blue whales, shows that the Operational Area lies within their distribution range.

1.3.1.2 Humpback Whale (Vulnerable/Migratory)

Humpback whales (*Megaptera novaeangliae*) have been observed in all oceans worldwide, and are considered the most common baleen whale species in Australia during the Austral winter. They were listed as vulnerable due to their small population size following unsustainable historic whaling practices (Threatened Species Scientific Committee, 2015).

Humpback whales have migration patterns similar to those of blue whales, with seasonal migration through the waters of northwest Australia, from Antarctic summer feeding grounds to winter calving grounds off the Kimberley coast. Southern migration from the calving grounds peaks from late-August to early September but can extend to as late as November in some years (Jenner *et al.*, 2001).

The migration path usually stays within 50 km offshore south of Shark Bay and extends to up to 100 km offshore in the Kimberley region (DoEE, 2017). The southward migration path is typically closer to the coastline (generally in waters less than 200 m water depth), through some areas identified as important corridors which include the coastal waters off Geraldton and around the Abrolhos Islands (more than 800 km away), as well as the coastal area from Point Cloates, at the base of the Ningaloo Coast, extending toward the North West Cape (Jenner *et al.*, 2001). Considering the steadily-increasing humpback whale population size in WA, small numbers may travel through the Operational Area during the migratory season. The Operational Area lie within the BIA for humpback whales migratory distribution range (DoEE, 2017b).

1.3.1.3 Sei Whale (Vulnerable/Migratory)

The Sei whale (*Balaenoptera borealis*) has a patchy and wide-ranging distribution, favouring deep, offshore habitat more than other large whale species. During the summer they are found between latitudes of 40° to 50° south, and lower winter latitudes are unknown (DotE, 2016b). As Sei whales are not often found near the coastline, the species is infrequently recorded in Australian waters. There is currently no BIA for the sei whale (DoEE, 2016b). As they prefer higher latitudes and colder waters, it is considered unlikely that significant numbers of the species will be present in the Operational Area.

1.3.1.4 Fin Whale (Vulnerable/Migratory)

Fin whales *(Balaenoptera physalus)* inhabit offshore waters from tropical to polar regions worldwide. They have been recorded in small numbers in the waters off Western Australia, South Australia, Victoria and Tasmania. As there is a lack of recorded sightings in Australia, abundance and distribution in Australia has been interpolated primarily from whaling records and stranding events. It is likely that fin whales migrate between Australian waters and Antarctic and subantarctic feeding areas and tropical breeding areas in Indonesia (DotE, 2016c). There is currently no BIA for fin whales (DoEE, 2016b). Based upon the low numbers of sightings in the Operational Area, it is unlikely that significant populations of fin whale would be present at any time.

1.3.1.5 Bryde's Whale (Migratory)

Bryde's whales may be found in all temperate and tropical waters in the Pacific Ocean, Indian Ocean and Atlantic Ocean (Kato, 2002). Population estimates are not available for this species, globally or in Australia, and no migration patterns have been documented in Australian waters (DotE, 2016d).

Bryde's whales have been recorded in both oceanic and inshore waters off all Australian states, except the Northern Territory (DotE, 2016d). Two forms are recognised: inshore and offshore Bryde's whales. Inshore whales live in coastal water less than 200 m, moving in response to prey availability (DotE, 2016d). The offshore form is found in deeper waters (500 to 1000 m) and may migrate seasonally, travelling to warmer tropical waters during the winter, although migration are not well known, and it is believed that they may also remain in warmer waters year round (Kato, 2002).

Individual Bryde's whales have been observed feeding in coastal waters off Carnarvon, and presumed to be part of a non-migratory population (Bannister *et al,.* 1996). Bryde's whale sightings have also been recorded from the Abrolhos Islands and north of Shark Bay (Bannister *et al,* 1996). There is documented evidence that these whales may be also found in deep waters (500-1,000 m).

BIAs for Bryde's whales have not been identified (DoEE, 2016b). The Operational Area is unlikely to represent important habitat for Bryde's whales as there is a lack of recorded sightings in the region, but low numbers of this species may transit through the Operational Area on occasion.

1.3.1.6 Killer Whale (Migratory)

Killer whales (*Orcinus orca*) have a widespread distribution from polar to equatorial waters around the globe, with preferred habitats of oceanic, pelagic and neritic (relatively shallow waters over the continental shelf) regions (DotE, 2016e). There is no reliable estimate of the global population of killer whales; although regions with well-studied populations of killer whales have abundance estimates available (Ford 2002). The species is listed as Data Deficient by the IUCN.

In Australia, killer whales have been recorded from all state waters and along the Australian continental shelf (Bannister *et al.*, 1996). They appear to be more abundant in cold, deep waters (Bannister *et al.*, 1996). The only area with regular sightings of killer whales is Macquarie Island, a Tasmanian State Reserve and World Heritage Site (Bannister *et al.*, 1996). In South Australia, reports of killer whales included groups of about 10-50 individuals, and frequent sightings of killer whales have also been collected from the Antarctic and Victoria (Bannister *et al.*, 1996). There is no evidence of killer whale migratory behaviour around Australia, and their frequent sightings may be influenced by seasonal changes in prey availability (Bannister *et al.*, 1996).

There are no recognised key habitats or BIAs for killer whales (DoEE, 2016b). Given their wide distribution range, the low numbers recorded in the area historically, their apparent preference for colder waters, this species is unlikely to be present in significant numbers in the Operational Area. Any animals that may occur are likely to be individuals or small groups transiting the area.

1.3.1.7 Sperm Whale (Migratory)

Sperm whales (*Physeter macrocephalus*) are found worldwide and are the largest of all the toothed whale species. Their global distribution is comparable to the killer whale, with regular observations from both polar and equatorial waters (Whitehead, 2002). The IUCN Red List status for sperm whales is Vulnerable.

Sperm whales are sighted frequently in deeper waters and form large aggregations (100–1,000 animals) in foraging grounds of high oceanic productivity (Whitehead, 2002). Female sperm whales have restricted home ranges in water deeper than 1,000 m and less than 40° latitudes (Whitehead, 2002). Male sperm whales will remain with their mothers for several years until early adulthood (4–21 years), at which time they will join larger male-only herds that will migrate to polar waters to feed, and return back to tropical and temperate waters to breed (Whitehead, 2002). No global population estimates for sperm whales are available.

In Australia, sperm whales are most commonly found in deep waters (greater than 600 m) off the continental shelf of all Australian states (Bannister *et al.,* 1996). There are no population estimates for sperm whales in Australia, with information regarding their presence and distribution gathered from incidental sightings and stranding records (DotE, 2016f). Bannister *et al.*, (1996) considered it likely that they are more than tens of thousands of sperm whales in Australian waters.

Detailed information on the distribution of sperm whales off WA is not available, but the species is known to aggregate in a narrow area only a few miles wide at the shelf edge off Albany (DotE, 2016f), and between Cape Leeuwin and Esperance (over 1,500 km

south of the field) (Bannister *et al.*, 1996). It is presumed that in WA, sperm whales are dispersed along the shelf edge and deeper offshore.

The closest listed BIA for the species is foraging grounds west of the Perth Canyon. This is over 900 km from the Operational Area (DotE, 2016f). However, the absence of significant sightings in the region suggests numbers are likely to be low.

1.3.1.8 Spotted Bottlenose Dolphin (Migratory)

The spotted bottlenose dolphin (*Tursiops aduncus*) can be found in the warm temperate to tropical waters of the Indo-Pacific ocean, from South Africa in the west, along the rim of the Indian Ocean to the southern half of Japan and southeast Australia in the east (Hammond *et al.*, 2008; Möller and Beheregaray, 2001). It is also found around oceanic islands distant from major land masses within this range.

Spotted bottlenose dolphins generally occur over shallow coastal waters on the continental shelf or around oceanic islands. They sometimes occur in mixed groups with common bottlenose dolphins and other delphinid species. They feed on a wide variety of schooling, demersal and reef fishes, as well as cephalopods (Hammond *et al.*, 2008).

Few estimates of abundance have been made for this species, however recent reports estimate the population size offshore from WA (specifically around Shark Bay) to be at least 2,000-3,000 (Hammond *et al.*, 2008). Given the wide-ranging distribution this species may occasionally be sighted, albeit in low numbers.

The closest BIA to the OA is over 750 km north east at Roebuck bay, a region of tidal mangrove creeks, extensive tidal mudflats and rich and consistent prey availability, where calving, foraging and breeding for the spotted bottlenose dolphin is known to occur (DoEE, 2016b).

1.3.2 Marine Reptiles

Threatened and migratory marine reptiles within the Operational Area are listed in Section 6.2 of the EP. Details on the species identified are included below.

1.3.2.1 Short-Nosed Seasnake (Critically Endangered)

The short-nosed seasnake is endemic to Western Australia. The species prefers to inhabit reef flats or shallow waters along the outer reef edge in water depths to 10 m (Cogger, 2000; Guinea, 1993; McCosker, 1975). Individuals have been observed in daylight hours, resting beneath small coral overhangs or coral heads in water 1-2 m deep (McCosker, 1975). Guinea and Whiting (2005) reported that some short-nosed seasnakes may move up to 50 m away from the reef flat.

The short-nosed seasnake has been recorded from the Exmouth Gulf, Western Australia (Storr *et al.*, 2002) to the reefs of the Sahul Shelf, which lie in the eastern Indian Ocean. As there are no reefs or shallow waters in the Operational Area it is extremely unlikely the short nosed seasnake would be present.

1.3.2.2 Leaf-scaled Seasnake (Critically Endangered)

For a long time, the Leaf-scaled Seasnake was known only from the reefs of the Sahul Shelf in Western Australia, especially on Ashmore and Hibernia Reefs (Cogger 2000; Minton & Heatwole 1975; Storr et al. 2002) in the North-west Bioregion (DEWHA 2008b). Research published in 2015 (D'Anastasi et al), significantly increased the known geographic range and habitat of the species to include seagrass meadows in Shark Bay in coastal Western Australia.

There are no reefs or shallow seagrass habitat in the waters of the Operational Area making it extremely unlikely that the Leaf-scaled Seasnake would be present.

1.3.2.3 Marine Turtles

Threatened and migratory marine turtles within the Operational Area are listed in Section 6.2 of the EP. Details on the species identified are included below.

Due to open oceanic conditions, there are no particular features that would result in feeding or breeding aggregations of turtle species within the Operational Area.

Green Turtle (Vulnerable/Migratory)

Green turtles (*Chelonia mydas*) are found in tropical and subtropical waters throughout the world. There are seven distinct genetic populations of green turtles in Australia, the largest of which nests in WA. This WA population is thought to be one of the largest green turtle populations worldwide (Limpus, 2009). Given the water depths in the Operational Area, the area is unlikely to represent important habitat for green turtles during any life history phase.

Flatback Turtle (Vulnerable/Migratory)

Flatback turtles (*Natator depressus*) are found only in the tropical waters of northern Australia, Papua New Guinea and Indonesia. There are four known genetic populations of this species, namely eastern Australia, Gulf of Carpentaria, western Northern Territory and WA (Limpus, 2009). The species is listed as Vulnerable (and Migratory) under the EPBC Act and Data Deficient under the IUCN Red List of Threatened Species.

Nesting is restricted to the northern Australian coastline, from Exmouth, WA, to Bundaberg, Queensland (Limpus, 2009). One of the largest known flatback turtle rookeries in WA is located along the east coast of Barrow Island, with a female reproductive population estimated to comprise approximately 3,900 turtles. A further 3,000 female flatback turtles are also found nesting on the nearby Lowendal and Montebello Islands; bringing the total estimated female reproductive population size for the Barrow-Montebello-Lowendal Island complex to 6,900 (Chevron Australia, 2009). Lesser numbers of flatback turtles are also known to nest on islands between Barrow Island and Exmouth, including Thevenard Island, Ashburton Island and Locker Island (Limpus, 2009; RPS, 2010).

The peak nesting season for flatback turtles in the southern Pilbara is from December–January (Pendoley, 2005; Chevron Australia, 2009) and the full nesting season is likely to extend from October–March (RPS, 2010). Based on the inferred nesting season,

mating is likely to occur from about September–November each year. Flatback turtle mating areas in WA are unknown (Chevron Australia, 2009), but are likely to be near the nesting beaches (Hamann *et al.*, 2002).

Between nesting events, flatback turtles either remain near their nesting beach, or travel up to 70 km to the mainland of WA (Chevron Australia, 2009; RPS, 2010). Some flatback turtles that nest in the southern Pilbara migrate to the northern Pilbara/Kimberley at the end of the nesting season (Chevron Australia, 2009; RPS, 2010). These turtles generally remain within the 70 m isobath while in the vicinity of the Barrow-Montebello-Lowendal Island complex (Chevron Australia, 2009; RPS, 2010). Other flatback turtles that nest in the southern Pilbara remain there at the end of the nesting season (Chevron Australia, 2009; RPS, 2010).

Adults are known to inhabit soft bottom habitat and forage in turbid shallow near-shore water in areas 5 to 20 m deep (Limpus *et al.*, 1983). Recent satellite telemetry data suggests that areas of 20–100 m water depth between Barrow Island and the Muiron Islands may be important for flatback turtle foraging (RPS, 2010). Flatback turtles feed on invertebrates such as cuttlefish, jellyfish, soft corals, sea pens and holothurians (DotE, 2016h; Limpus, 2009) and are likely to be found foraging in habitats that support these organisms.

Considering the significant numbers of flatback turtles that occur in WA, it is possible that some may travel through the Operational Area on occasion, and the Operational Area overlaps the BIA for the flatback turtle. Water depths in the Operational Area suggest the area is unlikely to comprise important habitat for the turtles during any life history phase of the species.

Hawksbill Turtle (Vulnerable/Migratory)

Hawksbill turtles (*Eretmochelys imbricate*) are found in tropical, subtropical and temperate waters in all oceans of the world. The total population of hawksbill turtles in Australia is unknown. However, it is known that Australia holds the largest breeding populations of hawksbill turtles in the world, and the largest rookeries (DotE, 2016i). It is estimated that around 3,000 females nest in WA each year (DotE, 2016i).

Hawksbill turtles spend the first five to ten years of their life drifting on ocean currents (DotE, 2016i). During this pelagic phase, they are often found in association with rafts of Sargassum (DotE, 2016i). Once hawksbill turtles reach 30 to 40 cm in length, they settle to forage in tropical tidal and sub-tidal rocky and coral reef habitat. They have also been found, those less regularly, in coastal seagrass habitat and within the deep waters of trawl fisheries. Foraging areas for hawksbill turtles in WA are poorly described, however nesting hawksbill turtles from the Lowendal Islands and Dampier Archipelago have been tracked to presumed foraging grounds in the Pilbara region, including the De Grey River mouth, Great Sandy Island, the Mary Anne Islands and Nickol Bay, and Sholl Island (Pendoley, 2005). Hawksbill turtles feed primarily on sponges, but also forage on cephalopods, gastropods, cnidarians, seagrass and seaweed (Carr & Stancyk, 1975; Witzell, 1983; Limpus, 1992; Spotila, 2004) and are likely to be found foraging in habitats that support these organisms.

Nesting is mainly confined to tropical beaches (DotE, 2016i). The major nesting areas of hawksbill turtles in WA are the Dampier Archipelago, the Ningaloo and Jurabi Coasts, as well as Thevenard, Barrow, Lowendal and Montebello Islands.

The peak hawksbill turtle nesting season in the Pilbara is between October and December (Pendoley, 2005). Mating can therefore be expected to occur from about September–October and is likely to occur in shallow waters close to nesting beaches. The inter-nesting period is generally spent close to the nesting beach (Pendoley, 2005).

Hawksbill turtles occur a number of WA marine reserves (DotE, 2016i), which are managed to protect feeding grounds, nesting grounds and inter-nesting habitat (where females occur during non-breeding times) for marine turtles in Australia, including the hawksbill turtle:

- Ashmore and Cartier Nature Reserves
- Ningaloo Marine Park
- Shark Bay World Heritage Area
- Dampier Archipelago Nature Reserve
- Thevenard Island Nature Reserve
- Barrow Island Nature Reserve
- Montebello Conservation Park
- Cape Range Conservation Park
- Muiron Islands Nature Reserve.

Average incubation periods for hawksbill turtle nests in northern Queensland are between 55 and 59 days (Limpus, 2009). Therefore, the peak hatching period in WA is expected to be between December and February. The in-water dispersal patterns and habitat use for hawksbill turtle hatchlings in WA are not known but it is likely that they travel to deep water, offshore habitats (Limpus, 2009).

Loggerhead Turtle (Endangered/Migratory)

Loggerhead turtles (*Caretta caretta*) are known to have a broad distribution (DotE, 2016q), occurring in proximity to coral and rocky reefs, seagrass beds and muddy bays throughout eastern, northern and Western Australia. Loggerhead turtles nest on sandy beach and the juvenile turtles spend their first several years adrift on the ocean currents. Once they become large enough, loggerhead turtles enter the benthic habitat to forage. Loggerhead turtles are carnivorous, feeding primarily on crustaceans and molluscs (Spotila, 2004) and are likely to be found foraging in areas that support high densities of these organisms.

The WA loggerhead turtle population nests on mainland beaches from Carnarvon to the Ningaloo Marine Park and offshore islands from Shark Bay to the Muiron Islands (Limpus, 2009). Very low density nesting occurs in other areas further north, including Locker Island and Ashmore Reef (Limpus, 2009).

Given the distance of the Operational Area from known loggerhead turtle rookeries and prospective foraging areas, it is unlikely that significant numbers of loggerhead turtles will be present at the location.

Leatherback Turtle (Endangered/Migratory)

The leatherback turtle (*Dermochelys coriacea*) has the widest distribution of any marine turtle species, and can be found in tropical, subtropical and temperate waters throughout the world (Marquez, 1990). Leatherback turtles are relatively rare in northern Australian waters. The species is more commonly observed in southern coastal waters around Australia.

No major breeding sites of leatherback turtles have been recorded in Australia (Limpus, 2009); however, scattered nesting occurs in the Northern Territory, along the coast of Arnhem Land. For example, low numbers of nesting females have been recorded at Cobourg Peninsula in north-west Arnhem Land (Chatto & Baker, 2008), with breeding occurring mostly during December and January.

Nesting occurs on tropical beaches and subtropical beaches (Marquez 1990) but no major centres of nesting activity have been recorded in Australia, although scattered isolated nesting (1-3 nests per annum) occurs in southern Queensland and Northern Territory (Limpus & McLachlin, 1994). However, leatherback turtles are the most pelagic of all marine turtles, and make long migrations between foraging areas and nesting beaches (DotE, 2016j).

Leatherback turtles may occasionally transit through the Operational Area. However, given the distance from known leatherback turtle rookeries and prospective foraging areas, it is unlikely that significant numbers will occur at the location.

1.3.3 Fish, Sharks and Rays

The North West Cape region is considered an important area for fish and shark biodiversity in Australia. The Operational Area is located approximately 110 km north-east of the North West Cape, which marks a boundary for a transition between demersal tropically dominated shelf and slope fish communities to dominant temperate species communities (Last *et al.*, 2005; Commonwealth of Australia, 2012).

The benthic and pelagic fish communities of the Northwest Shelf Province are strongly depth-related, indicative of a close association between fish communities and benthic habitats (Commonwealth of Australia, 2012). Deep water fish species, such as goatfish, lizardfish, ponyfish, threadfin bream, adult trevally, billfish and tuna are found in areas where water depths range between 100–200 m.

Table 1-1 presents spawning aggregation times for key fish species within the North Coast bioregion.

Table 1-1: Spawning aggregation times for key species within the North Coast bioregion (Dept of Fisheries)

Bioregion	Key Fish Species Within Zone	Spawning Aggregation Times
North Coast	Black shark (*Carcharhinus tilstoni and C. limbatus*)	Nov – Dec
	Goldband snapper (*Pristipomoides multidens*)	Jan – Apr
	Rankin cod (*Epinephelus multinotatus*)	Aug – Oct
	Red emperor (*Lutjanus sebae*)	Jan, Mar
	Pink snapper (*Pagrus auratus* (rare)	May – Jul
	Sandbank shark (*Carcharhinus plumbeus*)	Oct – Jan
	Spanish mackerel (*Scomberomorus commerson*)	Aug – Nov

Threatened and migratory fish, shark and rays within the Operational Area are listed in Section 6.2 of the EP. Details on the species identified are included below.

1.3.3.1 Whale Shark (Vulnerable/Migratory)

The whale shark (*Rhincodon typus)* has a broad distribution in tropical and warm temperate seas, usually between latitudes 30°N and 35°S (Wilson *et al.*, 2001; Wilson *et al.*, 2006). Whale sharks are highly migratory and the species' movements are closely associated with productivity pulses, ocean circulation and water temperatures, although this is little understood (DoEE, 2016c). Whale shark presence coincides with the coral mass spawning period, when there is an abundance of food (krill, planktonic larvae and schools of small fish) in the waters adjacent to the reef.

The whale shark may occasionally feed within the Operational Area and may travel through during migration. The foraging BIA (including high density prey) for the whale shark overlaps with the Operational Area.

1.3.3.2 Longfin Mako Shark (Migratory)

The longfin mako shark (*Isurus paucus*) is an oceanic tropical species and is only rarely encountered globally (Reardon *et al.*, 2006). This species is believed to be cosmopolitan in tropical and warm temperate waters and common in the Western Atlantic and possibly the Central Pacific. However, its distribution in Australian waters is poorly known, with only sporadic sightings (Reardon *et al.*, 2006). This is in part due to confusion with the more common shortfin mako shark (Compagno, 2001). Due to the wide distribution range of the species and the absence of any recognised important habitat in the Operational Area, the longfin mako shark is not expected to occur in the Operational Area in significant numbers.

1.3.3.3 Shortfin Mako Shark (Migratory)

The shortfin mako shark (*Isurus oxyrinchus*) is an active, offshore littoral and epipelagic species, found in tropical and warm-temperate seas from the surface down to at least 500 m, seldom occurring where water temperature is below 16 °C (Cailliet *et al.*, 2009). This species has been occasionally found close inshore where the continental shelf is narrow, and may occur from 20-50° between Australia and Chile, and to almost 60° south east of New Zealand (Reardon *et al.*, 2006). Due to the broad distribution of this species, they are unlikely to be found in significant numbers in the Operational Area.

1.3.3.4 Great White Shark (Vulnerable/Migratory)

The great white shark (*Carcharodon carcharias*) has a wide distribution, and is located throughout temperate and sub-tropical waters, from central Queensland, around the south coast and up to the north-west coast of Western Australia (DotE, 2016p). Great white sharks can be found from close to shore around rocky reefs, surf beaches and shallow coastal bays to outer continental shelf and slope areas (DotE, 2016p). Although they typically occur between the coast and the 100 m depth contour, they have been observed diving to 1,000 m (Bruce *et al.*, 2006). Great White Sharks have been recorded travelling very large distances and do not seem to reside in one area (DotE, 2016p). They are transient within the NWMR as they are known to prey on humpback whales and have been recorded at the North West Cape waters during migration season. The great white shark is often found close in-shore and penetrates shallow bays in continental coastal waters. There is no BIA for the great white shark located within the vicinity of the Operational Area, with the closest BIA being associated with the seal colony of the Houtman Abrolhos Islands off the coast of Geraldton, 600 km south of the OA (DoEE, 2016b).

Given the transient nature of great white sharks, and the lack of critical habitat present for this species, they are only expected to be present in low numbers in the Operational Area, either transiting through or foraging in the area.

1.3.3.5 Oceanic Whitetip Shark (Migratory)

The Oceanic Whitetip Shark is widespread throughout tropical and subtropical pelagic waters of the world. Within Australian waters, it is found from Cape Leeuwin through parts of the Northern Territory. It is a highly migratory species and therefore is only expected to be present in low numbers in the Operational Area, either transiting through or foraging in the area.

1.3.3.6 Grey Nurse Shark (Vulnerable)

The Grey Nurse Shark *(Carcharias taurus*) has a wide-ranging in-shore distribution, focused around main continental landmasses in sub-tropical to cool, temperate waters. The species is often recorded near in-shore rocky reefs, rocky caves, islands and sandy-bottomed gutters. They have also been observed in the surf zone and close to coral reefs. It is thought that this species is not restricted to any particular habitat. They tend to hover above the seabed at depths between 15 and 40 m. Grey Nurse sharks have also been recorded at depths of approximately 200 m on the continental shelf (Bennett & Bansemer 2004).

Grey nurse sharks have been recorded around most of the southern half of Australia and northwards to Shark Bay in WA (Cavanagh *et al.*, 2003). Within WA, grey nurse sharks are distributed along the coast and encountered with low and irregular frequency (DotE, 2016r). As the species occurs mainly on the south western-coastal waters (Chidlow *et al.*, 2006) it is considered unlikely to occur within the Operational Area. There are no identified BIAs for the grey nurse shark on the west coast of Australia (DoEE, 2016b).

1.3.3.7 Green Sawfish (Vulnerable)

The green sawfish (*Pristis zijsron)* occurs in in-shore coastal waters and riverine environments of tropical northern Australia (cited in DotE, 2016s; DotE, 2016t). The green sawfish is widespread in the Indo-west Pacific.

Sawfish are usually observed along the north-west coast of WA down to the Pilbara region. Green sawfish have historically been recorded in the coastal waters off Broome, WA, around northern Australia and down the east coast as far as Jervis Bay, New South Wales (NSW) (DotE, 2016s). Green Sawfish migration patterns are unknown (DotE, 2016s). Green sawfish been recorded in inshore marine waters, estuaries, river mouths, embankments and along sandy and muddy beaches (DotE, 2016s). Green sawfish have been recorded in very shallow water (< 1 m) to offshore trawl grounds in over 70 m of water (DotE, 2016s).

There is no biologically important area for sawfish within the Operational Area. The closest biologically important habitat for sawfish to the OA is 500 km to the north east.

1.3.3.8 Narrow Sawfish (Migratory)

The narrow sawfish occurs from the northern Persian Gulf to Australia and north to Japan, inhabiting estuarine waters and nearshore waters up to depths of 100 m (D'Anastasi *et al.*, 2013). While population declines have been observed globally, the narrow sawfish is not currently listed as threatened. Northern Western Australia, the Northern Territory, the Gulf of Carpentaria and Queensland east coast waters comprise the most ecologically functional populations worldwide, however these populations are suspected to have declined significantly from historic levels (D'Anastasi *et al.*, 2013). Narrow sawfish are commonly captured as bycatch and are the most commonly caught species of sawfish within the Northern Prawn Fishery as of 2015 (NPF, 2015). The species is likely to occur within the Operational Area, particularly in nearshore estuarine environments.

1.3.3.9 The Giant and Reef Manta Ray (Migratory)

Manta rays consist of two individual species; the giant manta ray (*manta birostris*) and the reef, or coastal manta ray (*manta alfredi*). The Giant Manta Ray is the largest ray species in the world and is found in tropical marine waters worldwide and only on occasion in temperate regions (DoF, 2011). The Giant Manta ray spends time on the surface, sometimes even jumping out of the water, and has also been observed diving to depths of over 1,000 metres (Arkive, 2016). The species is a seasonal visitor to coastal and offshore sites and is commonly recorded on productive coastlines with regular upwellings. Giant manta rays also visit shallow reefs to be cleaned by 'cleaner fishes' and to feed (Arkive, 2016).

Giant manta rays aggregate at Ningaloo Reef, in particular between March and April, however they may also occur in the Operational Area. Reef manta rays usually occur closer to shore, but there is no BIA for manta rays.

1.3.4 Seabirds/Shorebirds

Barrow, Lowendal and Montebello Islands are significant sites for migratory and resident seabirds and shorebirds (Commonwealth of Australia, 2012). Barrow, Lowendal and Montebello islands are internationally significant sites for six species of migratory shorebirds, supporting greater than 1% of the East Asian-Australasian Flyway populations of these species (Commonwealth of Australia, 2012). In addition, the Montebello/Barrow islands region is a significant rookery for at least 15 seabird species, with the largest breeding colony of Roseate tern in Western Australia found on the Montebello Islands (DEC, 2006).

Many of the species on the Montebello and Barrow islands are listed under the Japan-Australia Migratory Bird Agreement (JAMBA) and China migratory Bird Agreement (CAMBA) and it is expected that some individuals of these species would pass near the OA during their annual migration and may form temporary feeding aggregations, subject to food availability.

Threatened and migratory seabirds and shorebirds within the Operational Area are listed in Section 6.2 of the EP. Details on the species identified are included below.

1.3.4.1 Red Knot (Endangered/Migratory)

Distribution of the red knot in Western Australia is widespread, including the coast from Ningaloo and Barrow Island to the south-west Kimberly Division. Migration occurs to high northern latitudes during the northern hemisphere summer to breeding grounds where food is readily abundant, then southward to escape severe winter conditions under which energy demands are high and prey is scarce. Both Australia and New Zealand host significant populations of red knots during the non-breeding period (Bamford *et al.*, 2008). Important sites for the red knot in Western Australia include Eighty Mile Bay (population of 80,700) and Roebuck Bay (11,200) located over 500 km northwest of the OA (Bamford *et al.*, 2008). Similar to other migratory shorebirds, the red knot frequents intertidal sands, mudflats and coastal wetlands. As these habitats are not present within the Operational Area, occurrence of the species within the area is unlikely outside of brief migratory transit. However, the red knot may be present in

these habitats within nearby coastal areas during the non-breeding period. There is currently no BIA for this species.

1.3.4.2 Curlew Sandpiper (Critically Endangered/Migratory)

The curlew sandpiper (*Calidris ferruginea)* is a slim, small sandpiper with a long neck and long legs. Within Australia, Curlew Sandpipers are widespread across coastal habitats and also quite broadly distributed inland. In Western Australia, Curlew Sandpipers are widespread on coastal and subcoastal plains between Cape Arid to the south-west Kimberley Division, and are more sparsely distributed between Carnarvon and Dampier Archipelago (DotE, 2016v). There is currently no BIA for the curlew sandpiper, however the species is known to occur within the Operational Area.

1.3.4.3 Southern Giant-Petrel (Endangered/Migratory)

The southern giant-petrel is widespread throughout the Southern Ocean, breeding on six subantarctic and Antarctic islands within Australian territory. The worldwide population of the species is estimated at 62,000 individuals and is in continued rapid decline (DotE, 2016k). There are an estimated 7090 breeding pairs within Australian territory. In summer, it occurs predominantly in subantarctic to Antarctic waters, dispersing north during winter towards the Tropic of Capricorn, located south of the Operational Area. The southern giant-petrel is an opportunistic feeder, scavenging in coastal and island environments and surface seizing in open water environments (DotE, 2016k).

The only BIA for this species is on the east coast of Australia along the New South Wales coastline, which is listed as foraging habitat (DoEE, 2016b). Given that the northernmost extent of this species' described distribution does not overlap with the Operational Area, the southern giant petrel is not expected to be present in significant numbers within the Operational Area.

1.3.4.4 Eastern Curlew (Critically Endangered/Migratory)

The eastern curlew (*Numenius madagascariensis)* is Australia's largest shorebird. It is a long-haul flyer and easily distinguished by its long, downwards curving bill. The Eastern Curlew breeds in the Northern Hemisphere and arrives in Australia in August to forage for crabs and molluscs in intertidal mudflats (DotE, 2016n). It may transit through the area and could be expected to be occasionally sighted within the Operational Area. The closest habitat, on Barrow Island, is located over 35 km away from the Operational Area. There is no BIA for this species.

1.3.4.5 Australian Fairy Tern (Vulnerable/Migratory)

The Australian fairy tern (Sternula nereis nereis) feeds almost entirely on fish, foraging in in-shore waters around sheltered islands where it nests on sandy beaches. The Operational Area does not intersect foraging and breeding BIA for the fairy tern, which include Barrow Island, the Ningaloo Coast near Turquoise Bay and the marine waters near Thevenard Island. The species also has breeding grounds listed as BIAs on the Exmouth Peninsula within the Ningaloo Marine Park and on the mainland coastline 60 km south of Dampier (DoEE, 2016b).

However, it may occur within the OA in low numbers for foraging and feeding (DoEE, 2016b).

1.3.4.6 Common Noddy (Migratory)

The common noddy is distributed in tropical and sub-tropical waters off the west, north and east coasts of Australia and is also widespread across tropical areas of the Atlantic, Indian and Pacific oceans. The species breeds on islands in colonies and will stay nearby during breeding season, moving out to sea during non-breeding periods (Higgins & Davies, 1996). Breeding patterns differ between sites from annual, to twice per year in spring/early summer and autumn, to throughout the year on certain islands (King *et al.*, 1992). Common habitats during breeding periods are rocky islets and stacks, and shoals or cays of coral or sand, with foraging occurring in waters surrounding the nest. During non-breeding periods, the species is commonly found throughout the pelagic zone (Higgins & Davies, 1996).

The species is unlikely to occur within the Operational Area, aside from occasional transit through the area during migration. The nearest BIA for the common noddy (foraging) is over 650 km south in waters off the coast of Geraldton.

1.3.4.7 Streaked Shearwater (Migratory)

The streaked shearwater is distributed throughout the western Pacific, breeding on islands off the coast of China, North Korea, South Korea and at the coast or offshore islands of Japan and Russia (del Hoyo *et al.*, 1992, BirdLife International, 2017). Breeding occurs during March in colonies, typically within burrows on forested hills. During the northern hemisphere winter, the species migrates south to the coasts of Australia, New Guinea, the Philippines, Vietnam, Sri Lanka and southern India (del Hoyo *et al.*, 1992, BirdLife International, 2017). Foraging occurs over pelagic and inshore waters, from which the species seizes food from just below the surface (del Hoyo *et al.*, 1992). There is currently no BIA for the streaked shearwater. However, it is likely to occur within the Operational Area during non-breeding periods.

1.3.4.8 Lesser Frigatebird (Migratory)

The lesser frigatebird is native to numerous countries between latitudes 30°N and 20°S, with significant breeding populations found in tropical waters of the Indian and Pacific oceans (del Hoyo *et al.*, 1992). Individuals disperse throughout tropical seas during non-breeding periods, foraging in marine waters for fish and squid. The species' preferred breeding habitat is on remote tropical and sub-tropical islands, within bushes and mangroves or on bare ground (del Hoyo *et al.*, 1992). The Operational Area comprises favourable habitats for the lesser frigatebird, therefore it is expected to occur within these areas. The nearest BIA for the species (breeding and foraging) is over 250 km east of the OA.

1.3.4.9 Sandpipers (all Migratory)

Common Sandpiper

The common sandpiper has a wide breeding distribution, ranging from eastern Russia to western Europe, and is found throughout Australia, south and south-east Asia and

Africa (except near the equator) during non-breeding periods (Bamford *et al.*, 2008). Breeding occurs during May-June, with southward migration between mid-July and August until a return to breeding grounds around April (del Hoyo *et al.*, 1996). During non-breeding periods, the species inhabits inland wetland and coastal areas, such as estuaries, streams, pools, tidal creeks and freshwater seeps on coastal shores, but typically avoids large coastal mudflats (del Hoyo *et al.*, 1996; Snow and Perrins, 1998; Yalden, 1992). The common sandpiper is unlikely to occur within the Operational Area except during migratory movements.

Sharp-Tailed Sandpiper

The sharp-tailed sandpiper migrates southward from its breeding grounds across Asia to Australia, Indonesia, New Guinea and China where it resides during the northern hemisphere winter, with over 90% of the non-breeding population occurring in Australia (Bamford *et al.*, 2008). The non-breeding distribution within Australia is widespread with the species occurring in ephemeral wetlands inland, foraging within mudflats and grasslands (Bamford *et al.*, 2008). The sharp-tailed sandpiper is only expected to occur within the Operational Area during migratory transit.

Pectoral Sandpiper

The pectoral sandpiper breeds during the northern hemisphere summer in northern Russia and North America before migrating southwards. The species is transient through the Caribbean and Central America, moving to non-breeding habitats within South America and the tropical Pacific (Higgins & Davies, 1996). The species is rarely observed in Western Australia, but has been recorded at some locations including the coastal Gascoyne, the Pilbara and Kimberly regions between September-June (Higgins & Davies, 1996). The pectoral sandpiper typically found near coastal habitats but is occasionally found further inland. It inhabits bays, lagoons, estuaries, creeks, swamps, lakes, saltmarshes, floodplains and wetlands with low, emergent or fringing vegetation (Higgins & Davies, 1996). Foraging occurs in soft mud and shallow waters. As the species prefers coastal and inland habitats, it is not expected to occur within the Operational Area outside of migratory movements.

1.3.4.10 Osprey (Migratory)

The osprey is a species that may occur in the area, but is currently not listed as threatened under the EPBC Act. It is distributed across Australia, and there is currently no BIA for the species. The taxonomy of the osprey has been contested, with the most widely accepted being one species, with four subspecies, however the eastern osprey *Pandion cristatus* may also be recognised as its own species (DotE, 2016x). There are no published estimates on the population of the ospreys, and only well surveyed in NSW and South Australia. However it is known that they are common across Australia.

1.4 Cultural and Socio-Economic Environment

1.4.1 Commercial Fisheries

Commercial fisheries that operate in the waters of the NWS are centred in Onslow, 65 km to the south of the field; Exmouth, 120 km to the southwest, and Dampier, approximately 180 km to the east. The focus of commercial fishing activity is mainly the

inner continental shelf and waters surrounding the offshore islands to depths of about 30 m. Commonwealth and State Managed Fisheries that overlap the Operational Area are summarised below.

1.4.2 Commonwealth Fisheries

1.4.2.1 Western Tuna and Billfish Fishery

The Commonwealth managed Western Tuna and Billfish Fishery (WTBF) overlaps with the Operational Area, occupying a large area of the Australia Fishing Zone, extending westward from Cape York Peninsula (142°30′ E) off Queensland to 34°S off the west coast of Western Australia. It also extends eastward from 34°S off the west coast of WA, across the Great Australian Bight to 141°E at the South Australian/Victorian border (AFMA, 2012).

The WTBF also includes Australian waters outside of 12 nautical miles off Christmas Island and Cocos Keeling Islands. The WTBF Management Plan also applies to Australian vessels fishing on the high seas within the Indian Ocean Tuna Commission's (IOTC) Area of Competence (AFMA, 2012).

The 4 target species include Albacore Tuna (*Thunnus alalunga*), Bigeye tuna (*Thunnus obesus*), yellowfin tuna (*Thunnus albacares*), and broadbill sword fish (*Xiphius gladius*). The target species of the WTBF are highly migratory and internationally managed by the Indian Ocean Tuna Commission (IOTC).

Pelagic trawling is the main fishing method used in the WTBF; including the methods of pelagic longline, minor line (hand line, rod and reel, troll and poling) and purse seine. Most longliners that have operated in the WTBF have been 15-30 m long and have deployed monofilament longline gear.

352 tonnes of catch were landed in the 2013 season from four vessels using pelagic long lines (ABARES, 2014). This reduced to 316 tonnes of catch in 2014 from the same vessel effort (ABARES, 2015). Catch mainly consisted of striped marlin, swordfish, albacore, bigeye tuna and yellowfin tuna. Some fishing effort overlapped with the operational and regional areas in the 2013 season (ABARES, 2014); however, in recent years, effort has concentrated off south-west Western Australia, between Geraldton and Bunbury, over 740 km south of the OA (ABARES, 2015, 2017).

There is one active licence holder in the Western Tuna and Billfish Fishery, Ray Davies of Ocean Wild Tuna, who was consulted in March 2019.

Due to the low levels of effort in this fishery (fewer than five vessels active in the fishery each year since 2005 (ABARES, 2017)), the large area the fishery encompasses, concentration of fishing effort far south of the OA, and the PSZ that has been in place for the duration of the Woollybutt Field operations, it is unlikely that significant fishing effort coincides with the Operational Area.

1.4.2.2 Southern Bluefin Tuna Fishery

Although the area is licensed as part of the federally managed Southern Bluefin Tuna fishery, fishing does not occur within the Operational Area. Spawning of southern bluefin

tuna (*Thunnus maccoyi)* has been recorded on the North West Shelf from September to March and larvae are likely to be abundant in surface waters of the region throughout these months (Collette & Nauen, 1983; Davis *et al.*, 1990). Adult southern bluefin tuna may migrate through the region to the Southern Ocean, which is a key fishing ground for the Southern Bluefin Tuna Fishery.

1.4.2.3 Western Skipjack Fishery

The Western Skipjack Fishery extends westward from the South Australian-Victorian border across the Great Australian Bight, around the west coast of WA to Cape York Peninsula. Effort in this fishery is mainly confined to the southern coast of Australia, well outside of the Operational Area. In recent years there has been very little activity; no vessels were reported in 2015 (Patterson and Bath, 2016). As such, interactions with fishers are not expected.

1.4.3 State Fisheries

State-managed fisheries within the Operational Area are listed in Section 6.3.1.2 of the EP.

1.5 Values and Sensitivities

1.5.1 World Heritage Areas

There are no World Heritage Areas (WHA) within the Operational Area. The nearest WHA is the Ningaloo Coast, located over 200 km south west of the Operational Area. The Ningaloo Coast is also inscribed on the National Heritage List and is a State Marine Protected Area (DoEE, 2019).

1.5.1.1 Ningaloo Coast

The Ningaloo WHA encompasses the Ningaloo Marine Park (Section 1.5.5.2) and Muiron Islands Marine Management Area (Section 1.5.6.1) which sustain and protect a series of interconnected habitats. The statement of Outstanding Universal Value for the Ningaloo Coast WHA was based on the following natural criteria (DoEE, 2019):

Criterion (vii) contain superlative natural phenomena or areas of exceptional natural beauty and aesthetic importance

The landscapes and seascapes of the property are comprised of mostly intact and large-scale marine, coastal and terrestrial environments. The lush and colourful underwater scenery provides a stark and spectacular contrast with the arid and rugged land. The property supports rare and large aggregations of whale sharks (*Rhincodon typus*) along with important aggregations of other fish species and marine mammals. The aggregations in Ningaloo following the mass coral spawning and seasonal nutrient upwelling cause a peak in productivity that leads approximately 300-500 whale sharks to gather, making this the largest documented aggregation in the world.

Criterion (x) contain the most important and significant natural habitats for in-situ conservation of biological diversity, including those containing threatened

species of outstanding universal value from the point of view of science or conservation

In addition to the remarkable aggregations of whale sharks the Ningaloo Reef harbours a high marine diversity of more than 300 documented coral species, over 700 reef fish species, roughly 650 mollusc species, as well as around 600 crustacean species and more than 1,000 species of marine algae. The high numbers of 155 sponge species and 25 new species of echinoderms add to the significance of the area. On the ecotone, between tropical and temperate waters, the Ningaloo Coast hosts an unusual diversity of marine turtle species with an estimated 10,000 nests deposited along the coast annually.

The Ningaloo Coast WHA is an area of outstanding conservation value, supporting a rich array of habitats and a diverse and abundant marine life (DoEE, n.d.). Marine habitats present include mangroves, lagoons, coral reef, open ocean, continental slope and the continental shelf (CALM, 2005). The dominant feature of the Ningaloo Coast WHA is Ningaloo Reef, which supports both tropical and temperate species of marine fauna and flora and more than 300 species of coral (CALM, 2005).

The Ningaloo Coast WHA provides important nesting habitat for four species of marine turtle found in WA. The North West Cape and Muiron Islands are important nesting sites for loggerhead turtles (Department of Environmental Protection, 2001). The North West Cape is also a major nesting habitat for hawksbill and green turtles (DEC, 2008). Less significant nesting sites are found on the Muiron Islands for flatback and hawksbill turtles (DEC, 2008).

Each year, the largest congregation of whale sharks anywhere in the world takes place off the coast of the Ningaloo WHA between March and July, coinciding with the annual mass coral spawning events.

The statement of integrity for the property states that both the marine and the terrestrial areas of the property may face a number of threats to the property's integrity. In particular, potential off-shore hydrocarbon extraction in the region surrounding the property requires careful consideration in order to prevent potential pollution and disturbance. The coastline's significant length and remoteness poses major challenges to responses to pollution incidents suggesting a need for further investments in emergency response (DoEE, 2019).

1.5.2 National Heritage Areas

The Ningaloo Coast is National Heritage Place (NHP) that is also a WHA that is described in Section 1.5.1.

1.5.3 Commonwealth Heritage

There are two Commonwealth Heritage Areas, Learmouth Air Weapons Range Facility and the Ningaloo Marine Area – Commonwealth Waters located 200 km to the south west of the Operational Area. The Ningaloo Marine Area – Commonwealth Waters overlaps the Ningaloo Australian Marine Park which is described in Section 1.5.5.

Ecological values of the Learmouth Air Weapons Range Facility, which is located on the Cape Range Peninsula, are associated with the Cape Range Subterranean Waterways which are described in Section 1.5.4. Additional to values relating to subterranean fauna, the geomorphology of Cape Range is of considerable importance in documenting sea level and landform changes since the late Cenozoic (Wyroll, 1993).

1.5.4 Wetlands of International or National Importance

There are no wetlands of international or national importance within the Operational Area according to a search undertaken using the EPBC Protected Matters Search Tool (DoEE, 2021).

1.5.5 Australian Marine Parks

The Operational Area does not overlap with any Australian Marine Parks (AMP), although three occur nearby; Gascoyne AMP, Ningaloo AMP and Montebello AMP.

The North-West Marine Parks Network Management Plan 2018 (DNP, 2018) provides for the management of the network of Australia Marine Parks (AMP) in the North-West Network. The plan states that detailed implementation plans will be developed in the future to set out management actions and identify performance indicators for the North-West Network. However, the plan assigns an IUCN category to each marine park of the North-west Network, divides some marine parks into zones with their own category and sets out the objectives for each zone. Zoning takes into account the purposes for which the marine parks were declared, the objectives of the plan, the values of the marine park, and the requirements of the EPBC Act and EPBC Regulations. The management approach applied to activities within these zones are also described in the plan.

1.5.5.1 Gascoyne Australian Marine Park

The Gascoyne AMP is included in the North-West Marine Park Network Management Plan 2018 (DNP, 2018) which provides an overview of the significance and values of the AMP (Table 1-2).

Table 1-2: Gascoyne AMP significance and values

Overview
The Gascoyne Marine Park is located approximately 20 km off the west coast of the Cape Range Peninsula, adjacent to the Ningaloo Reef Marine Park and the Western Australian Ningaloo Marine Park, and extends to the limit of Australia's exclusive economic zone. The Marine Park covers an area of 81,766 km² and water depths between 15 m and 6000 m. The Marine Park was proclaimed under the EPBC Act on 14 December 2013 and renamed Gascoyne Marine Park on 9 October 2017. The Marine Park is assigned IUCN category IV and includes three zones assigned under this plan: National Park Zone (II), Habitat Protection Zone (IV) and Multiple Use Zone (VI).
Statement of Significance
The Gascoyne Marine Park is significant because it contains habitats, species and ecological communities associated with the Central Western Shelf Transition, Central Western Transition, and Northwest Province.

It includes four key ecological features:

Canyons linking the Cuvier Abyssal Plain and the Cape Range Peninsula (valued for unique seafloor features with ecological properties of regional significance).

Commonwealth waters adjacent to Ningaloo Reef (valued for high productivity and aggregations of marine life).

continental slope demersal fish communities (valued for high levels of endemism and diversity).

the Exmouth Plateau (valued as a unique seafloor feature with ecological properties of regional significance).

The Marine Park includes some of the most diverse continental slope habitats in Australia, in particular the continental slope area between North West Cape and the Montebello Trough. Canyons in the Marine Park link the Cuvier Abyssal Plain to the Cape Range Peninsula and are important for their role in sustaining the nutrient conditions that support the high diversity of Ningaloo Reef.

Natural Values

The Marine Park includes examples of ecosystems representative of:

- Central Western Shelf Transition—continental shelf with water depths up to 100 m, and a significant transition zone between tropical and temperate species
- Central Western Transition—characterised by large areas of continental slope, a range of topographic features such as terraces, rises and canyons, seasonal and sporadic upwelling, and benthic slope communities comprising tropical and temperate species
- Northwest Province—an area of continental slope comprising diverse and endemic fish communities.

Key ecological features of the Marine Park are:

- Canyons linking the Cuvier Abyssal Plain and the Cape Range Peninsula—an area resulting in upwelling of nutrient rich water and aggregations of marine life
- Commonwealth waters adjacent to Ningaloo Reef—an area where the Leeuwin and Ningaloo currents interact resulting in enhanced productivity and aggregations of marine life
- Continental Slope Demersal Fish Communities—an area of high diversity of demersal fish assemblages on the continental slope
- Exmouth Plateau—a regionally and nationally unique deep-sea plateau in tropical waters.

Ecosystems represented in the Marine Park are influenced by the interaction of the Leeuwin Current, Leeuwin Undercurrent and the Ningaloo Current.

The Marine Park supports a range of species including species listed as threatened, migratory, marine or cetacean under the EPBC Act. Biologically important areas within the Marine Park include breeding habitat for seabirds, internesting habitat for marine turtles, a migratory pathway for humpback whales, and foraging habitat and migratory pathway for pygmy blue whales.

Cultural Values

Sea country is valued for Indigenous cultural identity, health and wellbeing. Across Australia, Indigenous people have been sustainably using and managing their sea country for tens of thousands of years. The Gnulli people have responsibilities for sea country in the Marine Park.

The Yamatji Marlpa Aboriginal Corporation is the Native Title Representative Body for the Yamatji region.

Heritage Values

World heritage

The Ningaloo Coast was listed as an area of outstanding universal value under the World Heritage Convention in 2011, meeting world heritage listing criteria vii and x.

The Ningaloo Coast World Heritage Property is adjacent to the Marine Park. Refer to Section 1.5.1 for further details. *Commonwealth heritage* The Ningaloo Marine Area (Commonwealth waters) was established on the Commonwealth Heritage List in 2004, meeting the Commonwealth heritage listing criteria A, B and C. The Ningaloo Marine Area is adjacent to the Marine Park. *National heritage* The Ningaloo Coast was established on the National Heritage List in 2010, meeting the national heritage listing criteria A, B, C, D, and F and is adjacent to the Marine Park. Refer to Section 1.5.2 for further details. *Historic shipwrecks* The Marine Park contains more than five known shipwrecks listed under the *Historic Shipwrecks Act 1976*.
Social and Economic Values
Commercial fishing, mining and recreation are important activities in the Marine Park. These activities contribute to the wellbeing of regional communities and the prosperity of the nation.

1.5.5.2 Ningaloo Australian Marine Park

The Ningaloo AMP is included in the North-West Marine Park Network Management Plan 2018 (DNP, 2018) which provides an overview of the significance and values of the AMP (**Table 1-3**).

Table 1-3: Ningaloo AMP significance and values

Overview
The Ningaloo Marine Park stretches approximately 300 km along the west coast of the Cape Range Peninsula, and is adjacent to the Western Australian Ningaloo Marine Park and Gascoyne Marine Park. The Marine Park covers an area of 2435 km² and a water depth range of 30 m to more than 500 m. The Marine Park was originally proclaimed under the *National Parks and Wildlife Conservation Act 1975* on 20 May 1987 as the Ningaloo Marine Park (Commonwealth Waters), and proclaimed under the EPBC Act on 14 December 2013 and renamed Ningaloo Marine Park on 9 October 2017. The Marine Park is assigned IUCN category IV and includes two zones assigned under this plan: National Park Zone (II) and Recreational Use Zone (IV).
Statement of Significance
The Ningaloo Marine Park is significant because it contains habitats, species and ecological communities associated with the Central Western Shelf Transition, Central Western Transition, Northwest Province, and Northwest Shelf Province. It includes three key ecological features: • canyons linking the Cuvier Abyssal Plain and the Cape Range Peninsula (valued for unique seafloor features with ecological properties of regional significance) • Commonwealth waters adjacent to Ningaloo Reef (valued for high productivity and aggregations of marine life) • continental slope demersal fish communities (valued for high levels of endemism and diversity). The Marine Park provides connectivity between deeper offshore waters of the shelf break and coastal waters of the adjacent Western Australian Ningaloo Marine Park. It includes some of the most diverse continental slope habitats in Australia, in particular the continental slope area between North West Cape and the Montebello Trough.

Canyons in the Marine Park are important for their role in sustaining the nutrient conditions that support the high diversity of Ningaloo Reef.

The Marine Park is located in a transition zone between tropical and temperate waters and sustains tropical and temperate plants and animals, with many species at the limits of their distributions.

Natural Values

The Marine Park includes examples of ecosystems representative of:

- Central Western Shelf Transition—continental shelf of water depths up to 100 m, and a significant transition zone between tropical and temperate species
- Central Western Transition—characterised by large areas of continental slope, a range of topographic features such as terraces, rises and canyons, seasonal and sporadic upwelling and benthic slope communities comprising tropical and temperate species
- Northwest Province—an area of continental slope comprising diverse and endemic fish communities
- Northwest Shelf Province—a dynamic environment, influenced by strong tides, cyclonic storms, long-period swells and internal tides. The bioregion includes diverse benthic and pelagic fish communities, and ancient coastline thought to be an important seafloor feature and migratory pathway for humpback whales.

Key ecological features of the Marine Park are:

- Canyons linking the Cuvier Abyssal Plain and the Cape Range Peninsula—an area resulting in upwelling of nutrient rich water and aggregations of marine life
- Commonwealth waters adjacent to Ningaloo Reef—an area where the Leeuwin and Ningaloo currents interact, resulting in enhanced productivity and aggregations of marine life Continental slope demersal fish communities—an area of high diversity among demersal fish assemblages on the continental slope.

Ecosystems represented in the Marine Park are influenced by interaction of the Leeuwin Current, Leeuwin Undercurrent and the Ningaloo Current.

The Marine Park supports a range of species including species listed as threatened, migratory, marine or cetacean under the EPBC Act. Biologically important areas within the Marine Park include breeding and or foraging habitat for seabirds, internesting habitat for marine turtles, a migratory pathway for humpback whales, foraging habitat and migratory pathway for pygmy blue whales, breeding, calving, foraging and nursing habitat for dugong and foraging habitat for whale sharks.

Cultural Values

Sea country is valued for Indigenous cultural identity, health and wellbeing. Across Australia, Indigenous people have been sustainably using and managing their sea country for tens of thousands of years. The Gnulli people have responsibilities for sea country in the Marine Park.

The Yamatji Marlpa Aboriginal Corporation is the Native Title Representative Body for the Yamatji region.

Heritage Values

World heritage

The Marine Park is within the Ningaloo Coast World Heritage Property, recognised for its outstanding universal heritage values, meeting world heritage listing criteria vii and x. In addition to the Marine Park, the world heritage area includes the Western Australian Ningaloo Marine Park, the Murion Islands, the Western Australian Cape Range National Park and other terrestrial areas. The area is valued for high terrestrial species endemism, marine species diversity and abundance, and the interconnectedness of large-scale marine, coastal and terrestrial environments. The area connects the limestone karst system and fossil reefs of the ancient Cape Range to the nearshore reef system of Ningaloo Reef, to the continental slope and shelf in Commonwealth waters. Refer to Section 1.5.1 for further details.

National heritage The Ningaloo Coast overlaps the Marine Park and was established on the National Heritage List in 2010, meeting the national heritage listing criteria A, B, C, D, and F. Refer to Section 1.5.2 for further details. *Commonwealth heritage* The Ningaloo Marine Area (Commonwealth waters) was established on the Commonwealth Heritage List in 2004, meeting Commonwealth heritage listing criteria A, B and C. The Ningaloo Marine Area overlaps the Marine Park. *Historic shipwrecks* The Marine Park contains more than 15 known shipwrecks listed under the *Historic Shipwrecks Act 1976*.
Social and Economic Values
Tourism and recreation, including fishing, are important activities in the Marine Park. These activities contribute to the wellbeing of regional communities and the prosperity of the nation.

1.5.5.3 Montebello Australian Marine Park

The Montebello AMP is included in the North-West Marine Park Network Management Plan 2018 (DNP, 2018) which provides an overview of the significance and values of the AMP (Table 1-4).

Table 1-4: Montebello AMP significance and values

Overview
The Montebello Marine Park is located offshore of Barrow Island and 80 km west of Dampier extending from the Western Australian state water boundary, and is adjacent to the Western Australian Barrow Island and Montebello Islands Marine Parks. The Marine Park covers an area of 3413 km² and water depths from less than 15 m to 150 m. The Marine Park was proclaimed under the EPBC Act on 14 December 2013 and renamed Montebello Marine Park on 9 October 2017. The Marine Park is assigned IUCN category VI and includes one zone assigned under this plan.
Statement of Significance
The Montebello Marine Park is significant because it contains habitats, species and ecological communities associated with the Northwest Shelf Province. It includes one key ecological feature: • the ancient coastline at the 125 m depth contour (valued as a unique seafloor feature with ecological properties of regional significance). The Marine Park provides connectivity between deeper waters of the shelf and slope, and the adjacent Barrow Island and Montebello Islands Marine Parks. A prominent seafloor feature in the Marine Park is Trial Rocks consisting of two close coral reefs. The reefs are emergent at low tide.
Natural Values
The Marine Park includes examples of ecosystems representative of the Northwest Shelf Province—a dynamic environment influenced by strong tides, cyclonic storms, long-period swells and internal tides. The bioregion includes diverse benthic and pelagic fish communities, and ancient coastline thought to be an important seafloor feature and migratory pathway for humpback whales. A key ecological feature of the Marine Park is the ancient coastline at the 125 m depth contour where rocky escarpments are thought to provide biologically important habitat in areas otherwise dominated by soft sediments.

The Marine Park supports a range of species including species listed as threatened, migratory, marine or cetacean under the EPBC Act. Biologically important areas within the Marine Park include breeding habitat for seabirds, internesting, foraging, mating, and nesting habitat for marine turtles, a migratory pathway for humpback whales and foraging habitat for whale sharks.
Cultural Values
Sea country is valued for Indigenous cultural identity, health and wellbeing. Across Australia, Indigenous people have been sustainably using and managing their sea country for tens of thousands of years. At the commencement of this plan, there is limited information about the cultural significance of this Marine Park. The Yamatji Marlpa Aboriginal Corporation is the Native Title Representative Body for the Pilbara region.
Heritage Values
No international, Commonwealth or national listings apply to the Marine Park at commencement of this plan, however the Marine Park is adjacent to the Western Australia Barrow Island and the Montebello–Barrow Island Marine Conservation Reserves which have been nominated for national heritage listing. *Historic shipwrecks* The Marine Park contains two known shipwrecks listed under the *Historic Shipwrecks Act 1976*: *Trial* (wrecked in 1622), the earliest known shipwreck in Australian waters and *Tanami* (unknown date).
Social and Economic Values
Tourism, commercial fishing, mining and recreation are important activities in the Marine Park. These activities contribute to the wellbeing of regional communities and the prosperity of the nation.

1.5.5.4 Shark Bay Australian Marine Park

The Shark Bay AMP is included in the North-West Marine Park Network Management Plan 2018 (DNP, 2018) which provides an overview of the significance and values of the AMP (Table 1-5Table 1-4).

Table 1-5: Shark Bay AMP significance and values

Overview
The Shark Bay Marine Park is located approximately 60 km offshore of Carnarvon, adjacent to the Shark Bay world heritage property and national heritage place. The Marine Park covers an area of 7443 km², extending from the Western Australian state water boundary, and a water depth range between 15 m and 220 m. The Marine Park was proclaimed under the EPBC Act on 14 December 2013 and renamed Shark Bay Marine Park on 9 October 2017. The Marine Park is assigned IUCN category VI and includes one zone assigned under this plan: Multiple Use Zone (VI).
Statement of Significance
The Shark Bay Marine Park is significant because it contains habitats, species and ecological communities associated with the Central Western Shelf Province and Central Western Transition. The Marine Park provides connectivity between deeper Commonwealth waters and the inshore waters of the Shark Bay world heritage property.
Natural Values
The Marine Park includes examples of ecosystems representative of:

• Central Western Shelf—a predominantly flat, sandy and low-nutrient area, in water depths 50– 100 m. The bioregion is a transitional zone between tropical and temperate species; and • Central Western Transition—characterised by large areas of continental slope, a range of topographic features such as terraces, rises and canyons, seasonal and sporadic upwelling, and • benthic slope communities comprising tropical and temperate species . Ecosystems represented in the Marine Park are influenced by the Leeuwin, Ningaloo and Capes currents. The Marine Park supports a range of species including species listed as threatened, migratory, marine or cetacean under the EPBC Act. Biologically important areas within the Marine Park include breeding habitat for seabirds, internesting habitat for marine turtles, and a migratory pathway for humpback whales. The Marine Park and adjacent coastal areas are also important for shallow-water snapper.
Cultural Values
Sea country is valued for Indigenous cultural identity, health and wellbeing. Across Australia, Indigenous people have been sustainably using and managing their sea country for tens of thousands of years. The Gnulli and Malgana people have responsibilities for sea country in the Marine Park. The Yamatji Marlpa Aboriginal Corporation is the Native Title Representative Body for the Yamatji region.
Heritage Values
No international, Commonwealth or national heritage listings apply to the Marine Park at commencement of this plan, but the Marine Park is adjacent to the Shark Bay, Western Australia World Heritage Property and Shark Bay, Western Australia National Heritage Place. *Historic shipwrecks* The Marine Park contains approximately 20 known shipwrecks listed under the Historic Shipwrecks Act 1976.
Social and Economic Values
Tourism, commercial fishing, mining and recreation, including fishing, are important activities in the Marine Park. These activities contribute to the wellbeing of regional communities and the prosperity of the nation.

1.5.6 State Marine Protected Areas

No State-managed Marine Parks occur within the Operational Area. Two suites of conservation areas occur nearby; the Ningaloo Marine Park and Muiron Islands Marine Management Area, and the Barrow Island Marine Park/Marine Management Area and Montebello Marine Park.

1.5.6.1 Ningaloo Marine Park and Muiron Islands Marine Management Area

The Ningaloo Marine Park was established in 1987 and stretches 300 km from the North West Cape to Red Bluff. It encompasses the State waters covering the Ningaloo Reef system and a 40 m strip along the upper shore. The Muiron Islands Marine Management Area is managed under the same management plan as the Ningaloo State Marine Park (CALM, 2005). The Ningaloo Marine Park and Muiron Islands Marine Management Area are part of the Ningaloo Coast WHA (Section 1.5). They are located 72 kilometres south-west from the Operational Area.

Ecological and conservation values of the Ningaloo Marine Park and Muiron Islands are summarised below. Generally, all ecological values are presumed to be in an undisturbed condition except for some localised high use areas (CALM, 2005). The ecological and conservation values include:

- unique geomorphology resulting in high habitat and species diversity
- high sediment and water quality
- subtidal and intertidal coral reef communities providing resources for marine flora and fauna
- filter feeding communities (sponge gardens) in the northern part of the North West Cape and the Muiron and Sunday Islands
- shoreline intertidal reef communities providing feeding habitat for larger fish and other marine animals
- soft sediment communities found in deeper waters providing a rich food source food for invertebrates
- macroalgae and seagrass communities
- mangrove communities occur only in the northern part of the Ningaloo Marine Park
- diverse fish fauna (approximately 460 species)
- internesting, nesting and hatchling habitat for several species of marine turtles including the loggerhead, green, flatback and hawksbill turtles
- foraging aggregations of whale sharks between March to July
- seasonal shark aggregations and manta rays
- annual mass coral spawning on Ningaloo Reef
- marine mammals such as dugong and small cetacean populations frequenting or residing in nearshore waters, although these occur outside the area overlapped by the OA
- nesting and foraging habitat for seabirds and shorebirds.

The Ningaloo Marine Park and Muiron Islands Marine Management Area Management Plan 2005-2015 (CALM, 2005) outlines objectives for each value identified for this area and any potential or existing threats which could impact these values. These are discussed in Table 1-6. Considering the Operational Area does not overlap the Ningaloo Marine Park and Muiron Islands Marine Management Area, potential impacts would only relate to potential hydrocarbon spills reaching these areas and activities associated with any hydrocarbon spill response.

Table 1-6: Values, associated management objectives and relevant key threats from the Ningaloo Marine Park and Muiron Islands Marine Management Area Management Plan 2005-2015

Value	Associated management objectives	Relevant existing and potential threats identified in Management Plan	Relevant EP section
Ecological values			
Geomorphology	To ensure commercial and recreational access and use do not degrade coastal landforms within the reserves.	Not relevant	Not relevant
Sediment quality	To ensure that the sediment quality of the reserves is maintained at a level which supports and maintains the area's ecological and social values.	Not relevant	Not relevant
Water quality	To ensure the water quality of the reserves is maintained at a level which supports and maintains the areas ecological and social values.	No explicit threats from hydrocarbon spill, i.e.: • toxicant inputs from the accidental spillage of fuel and oils, or • hydrocarbon spills from passing ships	Not relevant
Coral reef communities	To ensure the diversity and abundance of coral reef communities in the reserves are not significantly impacted by human activities within the reserves.	Pollution events (shipping, oil/gas industry)	
Filter feeding communities (other than coral reefs)	To ensure that important filter feeding communities are not significantly impacted by human activities in the reserves.	Not relevant	Not relevant
Shoreline and intertidal communities	To ensure the diversity and abundance of shoreline intertidal reef communities in the reserves are not significantly impacted by trampling and recreational collecting within the reserves.	Pollution events (shipping, oil/gas industry)	Not relevant
Soft sediment communities	To ensure the species diversity and biomass of soft sediment communities within the reserves are not significantly impacted by human activities in the Park.	Not relevant	Not relevant
Macroalgal and seagrass communities	To ensure seagrass and macro-algal communities are not disturbed as a result of human activities in the reserves.	Pollution events (shipping, oil/gas industry)	Not relevant

Value	Associated management objectives	Relevant existing and potential threats identified in Management Plan	Relevant EP section
Mangrove communities	To ensure the species diversity and abundance of mangrove communities within the Park are not significantly impacted by trampling.	Pollution events (shipping, oil/gas industry)	
Coastal biological communities	To ensure that the species diversity and abundance of coastal biological communities within the Park are not significantly impacted by physical disturbances associated with grazing, trampling and 4WD access.	Not relevant	Not relevant
Seabirds, shorebirds and migratory waders	To ensure the species diversity and abundance of seabird, shorebird and migratory bird species in the reserves are not significantly impacted by human activity.	Pollution events (shipping, oil/gas industry)	Not relevant
Finfish	To ensure the species distribution and abundance of finfish species are not unacceptably impacted by recreational and commercial fishing in the reserves.	Not relevant	Not relevant
Invertebrates	To gain an understanding of the invertebrate diversity and abundance throughout the reserves to facilitate long-term management.	Not relevant	Not relevant
Sharks and rays	To ensure that shark diversity and abundance are not significantly impacted by recreational and commercial fishing activities in the reserves.	Not relevant	Not relevant
Whale sharks	To ensure whale sharks migrating through the reserves are not disturbed by boating and interaction activities.	Not relevant	Not relevant
Manta rays	To ensure that manta rays in the reserves are not significantly disturbed by interactive tours or recreational boat users or snorkelers.	Not relevant	Not relevant
Whales and dolphins	To ensure whales and dolphins in the reserves are not significantly disturbed by commercial whale interaction tours.	Not relevant	Not relevant

Value	Associated management objectives	Relevant existing and potential threats identified in Management Plan	Relevant EP section
Turtles	To ensure turtles in the reserves are not significantly disturbed by foxes or recreational activities on beaches (i.e. vehicles, walkers).	Not relevant	Not relevant
Dugong	To ensure dugong in the reserves are not significantly disturbed by human activity.	Not relevant	Not relevant
Social values			
No specific threats/management objectives identified for the Petroleum Activities Program.			

1.5.6.2 Barrow Island Marine Management Area, Barrow Island Marine Park and Montebello Islands Marine Park

The Management Plan for the Montebello/Barrow Islands Marine Conservation Reserves 2007-2017 (DEC 2007) directs management for three reserves, the Montebello Islands Marine Park, Barrow Island Marine Park and Barrow Island Marine Management Area. The reserves are located, approximately 30 km east from the Operational Area, and cover areas of approximately 58,331 ha, 4,169 ha and 114,693 ha respectively.

The Montebello/Barrow islands marine conservation reserves have very complex seabed and island topography including sheltered lagoons, channels, beaches and cliffs. This complexity has resulted in a myriad of different habitats in the reserves supported by high sediment and water quality. These habitats include subtidal coral reefs, macroalgal and seagrass communities, subtidal soft-bottom communities, rocky shores and intertidal reef platforms, which support a rich diversity of invertebrates and finfish. The mangrove communities are made of up six species and are considered to be globally significant because they occur in lagoons of offshore islands. The reserves are important breeding areas for several species of marine turtles and seabirds, which use the undisturbed sandy beaches for nesting. Humpback whales migrate through the reserves and dugongs occur in the shallow warm waters (DEC, 2007).

The specific ecological and social values of the reserves are listed below (DEC, 2007).

Summary of Ecological Values

- **Geomorphology:** A complex seabed and island topography consisting of subtidal and intertidal reefs, sheltered lagoons, channels, beaches and cliffs.
- **Sediment quality:** The sediments of the reserves are generally pristine, which is essential to the maintenance of healthy marine ecosystems.
- **Water quality:** The waters of the reserves are generally pristine, which is essential to the maintenance of healthy marine ecosystems.
- **Coral reef communities:** Undisturbed intertidal and subtidal coral reefs and bommies with a high diversity of hard corals.

- **Mangrove communities:** Six species of mangroves are found in the reserves, with the Montebello Islands' mangrove communities considered globally unique as they occur in lagoons of offshore islands.
- **Macroalgal and seagrass communities:** Extensive subtidal macroalgal and seagrass communities are important primary producers and refuge areas for fishes and invertebrates.
- **Rocky shore/intertidal reef platform communities:** Rocky shores predominate on most of the islands of the reserves and provide habitat for a variety of intertidal organisms, which in turn provide food for shorebirds.
- **Intertidal sand/mudflat communities:** The intertidal sand/mudflat communities are primary producers with an abundant invertebrate fauna, which provides a valuable food source for shorebirds.
- **Subtidal soft-bottom communities:** Subtidal sand and silt habitats support a variety of fauna including burrowing invertebrates and filter-feeding communities.
- **Marine mammals:** Ten species of cetaceans are recorded from the reserves, with the humpback whale passing through the area during its annual migration. Dugongs are found in the shallow warm waters.
- **Turtles:** Green, flatback, hawksbill, loggerhead and leatherback turtles are found in the reserves, with the Western Australian hawksbill population being the largest remaining in the Indian Ocean. Four species use sandy beaches in the reserves for nesting.
- **Seabirds:** The reserves provide important feeding and resting areas for migrating shorebirds. Islands within the reserves are nesting areas for 15 species of seabirds.
- **Finfishes:** A rich finfish fauna with at least 456 species.
- **Invertebrates:** A diverse marine invertebrate fauna comprising mostly tropical species.

Summary of Social Values

- **Hydrocarbon exploration and production industry:** The Montebello/Barrow islands region is within the State's most productive petroleum area (for both oil and gas).
- **Pearling:** The warm pristine waters of the reserves provide optimal conditions for production of high quality pearls by the existing pearling operations.
- **Nature-based tourism:** The reserves are developing rapidly as an important area for the nature-based tourism industry, with charter boats taking tourists to the Montebello Islands to participate in activities such as fishing, diving, wildlife viewing, island exploring and surfing.
- **Commercial fishing:** The reserves are used by commercial fishers targeting a variety of finfish, sharks and beche de mer.
- **Recreational fishing**: Excellent shore and boat-based recreational fishing opportunities targeting a variety of pelagic and reef finfish species, mud crabs and other edible invertebrates.

- **Water sports:** The natural values, climate, and scenic values provide the basis for a wide range of recreational activities.
- **European history/maritime heritage:** The Montebello Islands have a history of European contact dating from 1622, which includes pearling, whaling, fishing for turtles and, more recently, British atomic testing.
- **Scientific research:** The undisturbed nature and wide variety habitats and communities within the reserves provide unique opportunities for scientific research.

The Management Plan for the Montebello/Barrow Islands Marine Conservation Reserves 2007-2017 (DEC 2007) outlines objectives for each value identified for these areas and any potential or existing threats which could impact these values. These are discussed in Table 1-7. Considering the Operational Area does not overlap these areas, potential impacts would only relate to potential hydrocarbon spills reaching these and activities associated with any hydrocarbon spill response.

Table 1-7: Values, associated management objectives and relevant key threats from the Management Plan for the Montebello/Barrow Islands Marine Conservation Reserves 2007-2017

Value	Associated management objectives	Relevant existing and potential threats identified in Management Plan	Relevant EP section
Ecological values			
Geomorphology	1. To ensure the structural complexity of the reserves' geomorphology is not significantly reduced by installation of pipelines, or infrastructure development. 2. To ensure coastal landforms within the reserves are not significantly degraded by installation of pipelines, or infrastructure development.	Not relevant	Not relevant
Sediment quality	To facilitate long-term management by accumulating spatial and temporal information about impacts on sediment quality from various activities in the reserves.	Not relevant	Not relevant
Water quality	To facilitate long-term management by accumulating spatial and temporal information on impacts on water quality of various activities in the reserves.	Discharge of toxicants and physical and chemical stressors from accidental spillage of petroleum products.	Hydrocarbon spill risks and impacts are considered in Section 11 of the EP

Value	Associated management objectives	Relevant existing and potential threats identified in Management Plan	Relevant EP section
Coral reef communities	To ensure coral reef communities are not significantly impacted by accidental spillage of petroleum products or physical disturbance from development activities.	Accidental spillage of petroleum products.	
Macroalgal and seagrass communities	To gain an increased understanding of the macroalgal and seagrass communities in the reserves to facilitate long-term management.	Discharge of toxicants and other physical and chemical stressors from accidental spillage of petroleum products	Hydrocarbon spill risks and impacts are considered in Section 11 of the EP
Mangrove communities	To ensure that mangrove communities are not significantly impacted by physical disturbance or mud crabbing in the reserves.	Not relevant	Not relevant
Rocky shore/intertidal reef platform communities	To gain an increased understanding of the rocky shore/intertidal reef platform communities in the reserves to facilitate long-term management.	Accidental spillage of petroleum products	Hydrocarbon spill risks and impacts are considered in Section 11 of the EP
Intertidal sand/mudflat communities	To ensure that intertidal sand/mudflat communities are not significantly impacted by development activities in the reserves.	Discharge of toxicants and other physical and chemical stressors from accidental spillage of petroleum products	
Subtidal soft-bottom communities	To ensure that subtidal soft-bottom communities are not significantly impacted by physical disturbance in the reserves.	Discharge of toxicants and other physical and chemical stressors from accidental spillage of petroleum products	
Marine mammals	To gain an increased understanding of marine mammals in the reserves to facilitate long-term management.	Accidental spillage of petroleum products	
Turtles	To ensure no loss of species diversity and abundance of turtles in the reserves, particularly in relation to the potential impacts of lights and flares on hatchlings.	Accidental spillage of petroleum products.	
Seabirds	To gain an increased understanding of the seabirds of the reserves to facilitate long-term management.	Accidental spillage of petroleum products	

Value	Associated management objectives	Relevant existing and potential threats identified in Management Plan	Relevant EP section
Finfish	To gain an increased understanding of the finfish diversity and abundance throughout the reserves to facilitate long-term management.	Accidental spillage of petroleum products	
Invertebrates	To gain an increased understanding of the invertebrate diversity and abundance throughout the reserves to facilitate long-term management.	Accidental spillage of petroleum products	
Social values			
No specific threats/management objectives identified for the Petroleum Activities Program.			

1.5.7 Key Ecological Features

An EPBC Protected Matters Search shows that the Operational Area is located nearby a number of Key Ecological Features (KEF) which have been identified in the North-West Marine Bioregional Plan (Commonwealth of Australia, 2012). Under section 176 of the EPBC Act, once a bioregional plan has been made the minister responsible for the environment must have regard to it when making any decision under the Act to which the plan is relevant (DoEE, 2019).

The KEFs identified are:

- Ancient Coastline at 125 m depth contour (4 km west of Operational Area)
- Continental Slope demersal fish communities (13 km to west of Operational Area)
- Canyons linking the Cuvier Abyssal Plain and the Cape Range Peninsula (58 km to south west of Operational Area)
- Commonwealth waters adjacent to Ningaloo Reef (110 km to south west of Operational Area).
- Exmouth Plateau (130 km west of Operational Area).

1.5.7.1 Ancient Coastline at 125 m Depth Contour

The ancient coastline presents a unique portion of the seafloor with ecological features of regional importance (Commonwealth of Australia, 2012). The shelf of the Northwest Marine Region contains several terraces and steps which reflect the gradual increase in sea level across the shelf that occurred during the Holocene (Commonwealth of Australia, 2012). The most prominent of these occurs episodically as an escarpment through the North West Shelf (NWS) and Northwest Transition, at a depth of approximately 125 m. It has been suggested that humpback whales, whale sharks and other migratory pelagic species may use this escarpment as a guide as they move through the region (Commonwealth of Australia, 2012). Fauna associated with the hard substrate of the escarpment is likely to include sponges, corals, crinoids, molluscs,

echinoderms and other benthic invertebrates representative of hard substrate fauna in the North West Shelf bioregion (Commonwealth of Australia, 2012). Although the ancient coastline adds additional habitat types to a representative system, the habitat types would not be unique to the coastline as they are widespread on the upper shelf (Falkner *et al.*, 2009).

This KEF is located 4 km to the west of the Operational Area.

1.5.7.2 Continental Slope Demersal Fish Communities

The demersal fish assemblages on the continental slope in the Timor Province, the Northwest Transition and the Northwest Province are highly diverse and contain a number of endemic species (Commonwealth of Australia, 2012). The continental slope between North West Cape and the Montebello Trough has more than 500 fish species, 76 of which are endemic, which makes it the most diverse slope bioregion in Australia (Last *et al.*, 2005). The slope of the Timor Province and the Northwest Transition is also home to over 500 species of demersal fish, of which 64 are believed to be endemic (Last *et al.*, 2005). The Timor Province and Northwest Transition bioregions are the second-richest areas for demersal fish across the entire continental slope. The region is valued for its high levels of endemism (Commonwealth of Australia, 2012).

1.5.7.3 Canyons Linking the Cuvier Abyssal Plain and the Cape Range Peninsula

The canyons on the Cuvier Abyssal Plain and Cape Range Peninsula slope connect to the Commonwealth waters near Ningaloo Reef. The Leeuwin Current produces eddies inside the heads of the canyons, drawing waters from the Antarctic intermediate water mass into shallower depths and onto the shelf (Brewer *et al.*, 2007). Strong internal tides may also aid upwelling at the canyon heads (Brewer *et al.*, 2007). These waters are cool and nutrient-rich, and the narrow shelf width near the canyons facilitates nutrient upwelling, which interacts with the Leeuwin Current at the canyon heads. Aggregations of whale sharks, humpback whales, manta rays, sharks, sea snakes, large predatory fish and seabirds are known to occur within the area, linked to enhanced productivity (Sleeman *et al.*, 2007).

1.5.7.4 Commonwealth Waters Adjacent to Ningaloo Reef

Ningaloo Reef extends more than 260 km along Cape Range Peninsula with a landward lagoon 200 m to 6 km wide. The reef drops gently to depths of 8-10 m seaward of the reef crest, with waters reaching 100 m depth 5-6 km beyond the edge of the reef. Commonwealth waters over the narrow shelf (10 km at its narrowest) and shelf break are contiguous with Ningaloo Reef and linked by oceanographic and trophic cycling (Brewer *et al.*, 2007; DEWHA, 2008).

The Commonwealth waters adjacent to Ningaloo Reef and associated plateau and canyons support high productivity and species richness. Interactions occur between the Leeuwin and Ningaloo currents on the seaward side of the reef, resulting in corridors of enhanced productivity which form migratory pathways and support aggregations of whale sharks, humpback whales, manta rays, sharks, sea snakes, large predatory fish and seabirds (Donovan *et al.*, 2008; Gunn *et al.*, 1999; Waples & Hollander, 2008).

Detrital input from phytoplankton production in surface waters and from higher-trophic consumers cycles back to the deeper shelf and slope waters (Brewer *et al.*, 2007). Deep water biodiversity includes fish, sponges, molluscs, soft corals and gorgonians, with some of these communities appearing to differ significantly than those at other locations along the Australian coastline, suggesting that the Commonwealth waters adjacent to Ningaloo Reef are uniquely biodiverse (Rees *et al.*, 2004).

The KEF includes the Ningaloo Australian Marine Park and further information can be found in Section 1.5.5.

1.5.7.5 Exmouth Plateau

The Exmouth Plateau is defined as a KEF as it is a unique seafloor feature with ecological properties of regional significance. The Exmouth Plateau covers an area of 49,310 km^2 and is located approximately 150 km northwest of Exmouth. The plateau ranges in water depths from 800 to 4,000 m (Heap & Harris 2008 in DSEWPaC 2012). The plateau's surface is rough and undulating at 800–1,000 m depth. The northern margin is steep and intersected by large canyons (e.g. Montebello and Swan canyons) with relief greater than 50 m. The western margin is moderately steep and smooth and the southern margin is gently sloping and virtually free of canyons (Falkner et al. 2009 in DSEWPaC 2012).

The Exmouth Plateau may serve an important ecological role by acting as a topographic obstacle that modifies the flow of deep waters that generate internal tides, causing upwelling of deeper water nutrients closer to the surface (Brewer et al. 2007). Sediments on the plateau suggest that biological communities include scavengers, benthic filter feeders and epifauna. Whaling records from the 19th century suggest that the Exmouth Plateau may have supported large populations of sperm whales (Bannister et al. 2007). Fauna in the pelagic waters above the plateau are likely to include small pelagic species and nekton (Brewer et al. 2007).

1.6 Protected Matters Search Tool Results

Australian Government

Department of Agriculture, Water and the Environment

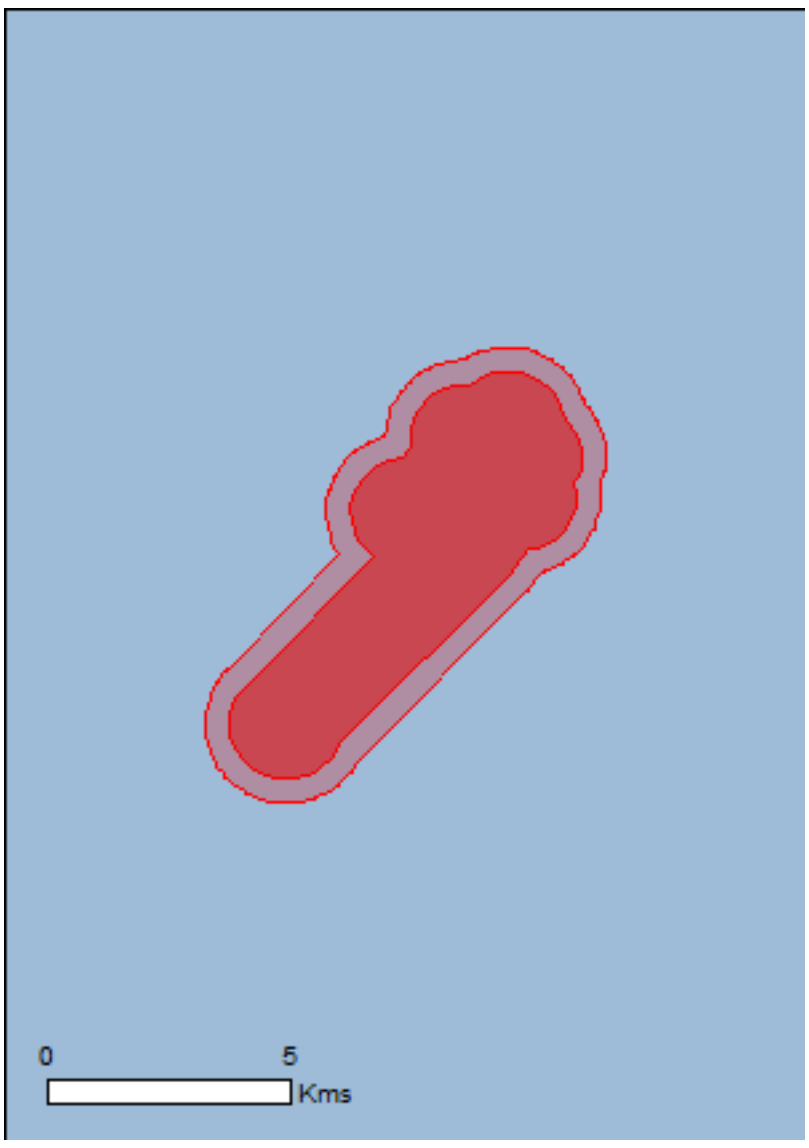
EPBC Act Protected Matters Report

This report provides general guidance on matters of national environmental significance and other matters protected by the EPBC Act in the area you have selected.

Information on the coverage of this report and qualifications on data supporting this report are contained in the caveat at the end of the report.

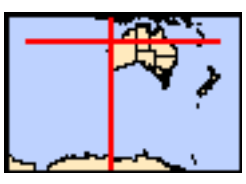
Information is available about Environment Assessments and the EPBC Act including significance guidelines, forms and application process details.

Report created: 04/07/21 17:13:24



Coordinates

Buffer: 0.5Km



Summary

Matters of National Environmental Significance

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

World Heritage Properties:	None
National Heritage Places:	None
Wetlands of International Importance:	None
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	1
Listed Threatened Ecological Communities:	None
Listed Threatened Species:	18
Listed Migratory Species:	33

Other Matters Protected by the EPBC Act

This part of the report summarises other matters protected under the Act that may relate to the area you nominated. Approval may be required for a proposed activity that significantly affects the environment on Commonwealth land, when the action is outside the Commonwealth land, or the environment anywhere when the action is taken on Commonwealth land. Approval may also be required for the Commonwealth or Commonwealth agencies proposing to take an action that is likely to have a significant impact on the environment anywhere.

The EPBC Act protects the environment on Commonwealth land, the environment from the actions taken on Commonwealth land, and the environment from actions taken by Commonwealth agencies. As heritage values of a place are part of the 'environment', these aspects of the EPBC Act protect the Commonwealth Heritage values of a Commonwealth Heritage place. Information on the new heritage laws can be found at http://www.environment.gov.au/heritage

A permit may be required for activities in or on a Commonwealth area that may affect a member of a listed threatened species or ecological community, a member of a listed migratory species, whales and other cetaceans, or a member of a listed marine species.

Commonwealth Land:	None
Commonwealth Heritage Places:	None
Listed Marine Species:	54
Whales and Other Cetaceans:	26
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Australian Marine Parks:	None

Extra Information

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

State and Territory Reserves:	None
Regional Forest Agreements:	None
Invasive Species:	None
Nationally Important Wetlands:	None
Key Ecological Features (Marine)	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 the Commonwealth Marine Area but which has, may have or is likely to have a significant impact on the environment in the Commonwealth Marine Area. Generally the Commonwealth Marine Area stretches from three nautical miles to two hundred nautical miles from the coast.

Name
EEZ and Territorial Sea

Marine Regions [Resource Information]

If you are planning to undertake action in an area in or close to the Commonwealth Marine Area, and a marine bioregional plan has been prepared for the Commonwealth Marine Area in that area, the marine bioregional plan may inform your decision as to whether to refer your proposed action under the EPBC Act.

Name
North-west

Listed Threatened Species [Resource Information]

Name	Status	Type of Presence
Birds		
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat may occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
Macronectes giganteus Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Species or species habitat may occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area
Sternula nereis nereis Australian Fairy Tern [82950]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Mammals		
Balaenoptera borealis Sei Whale [34]	Vulnerable	Species or species habitat likely to occur within area
Balaenoptera musculus Blue Whale [36]	Endangered	Species or species habitat likely to occur within area
Balaenoptera physalus Fin Whale [37]	Vulnerable	Species or species habitat likely to occur within area
Megaptera novaeangliae Humpback Whale [38]	Vulnerable	Species or species

Name	Status	Type of Presence
		habitat known to occur within area
Reptiles		
Caretta caretta Loggerhead Turtle [1763]	Endangered	Species or species habitat known to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Species or species habitat known to occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Species or species habitat likely to occur within area
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	Species or species habitat known to occur within area
Natator depressus Flatback Turtle [59257]	Vulnerable	Congregation or aggregation known to occur within area
Sharks		
Carcharias taurus (west coast population) Grey Nurse Shark (west coast population) [68752]	Vulnerable	Species or species habitat may occur within area
Carcharodon carcharias White Shark, Great White Shark [64470]	Vulnerable	Species or species habitat may occur within area
Pristis zijsron Green Sawfish, Dindagubba, Narrowsnout Sawfish [68442]	Vulnerable	Species or species habitat known to occur within area
Rhincodon typus Whale Shark [66680]	Vulnerable	Foraging, feeding or related behaviour known to occur within area

Listed Migratory Species [Resource Information]

* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.

Name	Threatened	Type of Presence
Migratory Marine Birds		
Anous stolidus Common Noddy [825]		Species or species habitat may occur within area
Calonectris leucomelas Streaked Shearwater [1077]		Species or species habitat likely to occur within area
Fregata ariel Lesser Frigatebird, Least Frigatebird [1012]		Species or species habitat likely to occur within area
Macronectes giganteus Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Species or species habitat may occur within area
Migratory Marine Species		
Anoxypristis cuspidata Narrow Sawfish, Knifetooth Sawfish [68448]		Species or species habitat may occur within area
Balaenoptera borealis Sei Whale [34]	Vulnerable	Species or species habitat likely to occur within area
Balaenoptera edeni Bryde's Whale [35]		Species or species

Name	Threatened	Type of Presence
		habitat may occur within area
Balaenoptera musculus Blue Whale [36]	Endangered	Species or species habitat likely to occur within area
Balaenoptera physalus Fin Whale [37]	Vulnerable	Species or species habitat likely to occur within area
Carcharhinus longimanus Oceanic Whitetip Shark [84108]		Species or species habitat likely to occur within area
Carcharodon carcharias White Shark, Great White Shark [64470]	Vulnerable	Species or species habitat may occur within area
Caretta caretta Loggerhead Turtle [1763]	Endangered	Species or species habitat known to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Species or species habitat known to occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Species or species habitat likely to occur within area
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	Species or species habitat known to occur within area
Isurus oxyrinchus Shortfin Mako, Mako Shark [79073]		Species or species habitat likely to occur within area
Isurus paucus Longfin Mako [82947]		Species or species habitat likely to occur within area
Manta alfredi Reef Manta Ray, Coastal Manta Ray, Inshore Manta Ray, Prince Alfred's Ray, Resident Manta Ray [84994]		Species or species habitat may occur within area
Manta birostris Giant Manta Ray, Chevron Manta Ray, Pacific Manta Ray, Pelagic Manta Ray, Oceanic Manta Ray [84995]		Species or species habitat likely to occur within area
Megaptera novaeangliae Humpback Whale [38]	Vulnerable	Species or species habitat known to occur within area
Natator depressus Flatback Turtle [59257]	Vulnerable	Congregation or aggregation known to occur within area
Orcinus orca Killer Whale, Orca [46]		Species or species habitat may occur within area
Physeter macrocephalus Sperm Whale [59]		Species or species habitat may occur within area
Pristis zijsron Green Sawfish, Dindagubba, Narrowsnout Sawfish [68442]	Vulnerable	Species or species habitat known to occur within area
Rhincodon typus Whale Shark [66680]	Vulnerable	Foraging, feeding or related behaviour known

Name	Threatened	Type of Presence
		to occur within area
Tursiops aduncus (Arafura/Timor Sea populations)		
Spotted Bottlenose Dolphin (Arafura/Timor Sea populations) [78900]		Species or species habitat may occur within area
Migratory Wetlands Species		
Actitis hypoleucos		
Common Sandpiper [59309]		Species or species habitat may occur within area
Calidris acuminata		
Sharp-tailed Sandpiper [874]		Species or species habitat may occur within area
Calidris canutus		
Red Knot, Knot [855]	Endangered	Species or species habitat may occur within area
Calidris ferruginea		
Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
Calidris melanotos		
Pectoral Sandpiper [858]		Species or species habitat may occur within area
Numenius madagascariensis		
Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area
Pandion haliaetus		
Osprey [952]		Species or species habitat may occur within area

Other Matters Protected by the EPBC Act

Listed Marine Species [Resource Information]		
* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.		
Name	Threatened	Type of Presence
Birds		
Actitis hypoleucos		
Common Sandpiper [59309]		Species or species habitat may occur within area
Anous stolidus		
Common Noddy [825]		Species or species habitat may occur within area
Calidris acuminata		
Sharp-tailed Sandpiper [874]		Species or species habitat may occur within area
Calidris canutus		
Red Knot, Knot [855]	Endangered	Species or species habitat may occur within area
Calidris ferruginea		
Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
Calidris melanotos		
Pectoral Sandpiper [858]		Species or species habitat may occur within area
Calonectris leucomelas		
Streaked Shearwater [1077]		Species or species habitat likely to occur

Name	Threatened	Type of Presence within area
[Fregata ariel](#) Lesser Frigatebird, Least Frigatebird [1012]		Species or species habitat likely to occur within area
[Macronectes giganteus](#) Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Species or species habitat may occur within area
[Numenius madagascariensis](#) Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area
[Pandion haliaetus](#) Osprey [952]		Species or species habitat may occur within area
Fish		
[Acentronura larsonae](#) Helen's Pygmy Pipehorse [66186]		Species or species habitat may occur within area
[Bulbonaricus brauni](#) Braun's Pughead Pipefish, Pug-headed Pipefish [66189]		Species or species habitat may occur within area
[Campichthys tricarinatus](#) Three-keel Pipefish [66192]		Species or species habitat may occur within area
[Choeroichthys brachysoma](#) Pacific Short-bodied Pipefish, Short-bodied Pipefish [66194]		Species or species habitat may occur within area
[Choeroichthys latispinosus](#) Muiron Island Pipefish [66196]		Species or species habitat may occur within area
[Choeroichthys suillus](#) Pig-snouted Pipefish [66198]		Species or species habitat may occur within area
[Doryrhamphus dactyliophorus](#) Banded Pipefish, Ringed Pipefish [66210]		Species or species habitat may occur within area
[Doryrhamphus janssi](#) Cleaner Pipefish, Janss' Pipefish [66212]		Species or species habitat may occur within area
[Doryrhamphus multiannulatus](#) Many-banded Pipefish [66717]		Species or species habitat may occur within area
[Doryrhamphus negrosensis](#) Flagtail Pipefish, Masthead Island Pipefish [66213]		Species or species habitat may occur within area
[Festucalex scalaris](#) Ladder Pipefish [66216]		Species or species habitat may occur within area
[Filicampus tigris](#) Tiger Pipefish [66217]		Species or species habitat may occur within area
[Halicampus brocki](#) Brock's Pipefish [66219]		Species or species habitat may occur within area
[Halicampus grayi](#) Mud Pipefish, Gray's Pipefish [66221]		Species or species habitat may occur within

Name	Threatened	Type of Presence
		area
Halicampus nitidus Glittering Pipefish [66224]		Species or species habitat may occur within area
Halicampus spinirostris Spiny-snout Pipefish [66225]		Species or species habitat may occur within area
Haliichthys taeniophorus Ribboned Pipehorse, Ribboned Seadragon [66226]		Species or species habitat may occur within area
Hippichthys penicillus Beady Pipefish, Steep-nosed Pipefish [66231]		Species or species habitat may occur within area
Hippocampus angustus Western Spiny Seahorse, Narrow-bellied Seahorse [66234]		Species or species habitat may occur within area
Hippocampus histrix Spiny Seahorse, Thorny Seahorse [66236]		Species or species habitat may occur within area
Hippocampus kuda Spotted Seahorse, Yellow Seahorse [66237]		Species or species habitat may occur within area
Hippocampus planifrons Flat-face Seahorse [66238]		Species or species habitat may occur within area
Hippocampus trimaculatus Three-spot Seahorse, Low-crowned Seahorse, Flat-faced Seahorse [66720]		Species or species habitat may occur within area
Micrognathus micronotopterus Tidepool Pipefish [66255]		Species or species habitat may occur within area
Phoxocampus belcheri Black Rock Pipefish [66719]		Species or species habitat may occur within area
Solegnathus hardwickii Pallid Pipehorse, Hardwick's Pipehorse [66272]		Species or species habitat may occur within area
Solegnathus lettiensis Gunther's Pipehorse, Indonesian Pipefish [66273]		Species or species habitat may occur within area
Solenostomus cyanopterus Robust Ghostpipefish, Blue-finned Ghost Pipefish, [66183]		Species or species habitat may occur within area
Syngnathoides biaculeatus Double-end Pipehorse, Double-ended Pipehorse, Alligator Pipefish [66279]		Species or species habitat may occur within area
Trachyrhamphus bicoarctatus Bentstick Pipefish, Bend Stick Pipefish, Short-tailed Pipefish [66280]		Species or species habitat may occur within area
Trachyrhamphus longirostris Straightstick Pipefish, Long-nosed Pipefish, Straight Stick Pipefish [66281]		Species or species habitat may occur within area
Reptiles		
Aipysurus laevis Olive Seasnake [1120]		Species or species habitat may occur within

Name	Threatened	Type of Presence
		area
Caretta caretta Loggerhead Turtle [1763]	Endangered	Species or species habitat known to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Species or species habitat known to occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Species or species habitat likely to occur within area
Disteira kingii Spectacled Seasnake [1123]		Species or species habitat may occur within area
Disteira major Olive-headed Seasnake [1124]		Species or species habitat may occur within area
Ephalophis greyi North-western Mangrove Seasnake [1127]		Species or species habitat may occur within area
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	Species or species habitat known to occur within area
Hydrophis czeblukovi Fine-spined Seasnake [59233]		Species or species habitat may occur within area
Hydrophis elegans Elegant Seasnake [1104]		Species or species habitat may occur within area
Natator depressus Flatback Turtle [59257]	Vulnerable	Congregation or aggregation known to occur within area
Pelamis platurus Yellow-bellied Seasnake [1091]		Species or species habitat may occur within area

Whales and other Cetaceans [Resource Information]

Name	Status	Type of Presence
Mammals		
Balaenoptera acutorostrata Minke Whale [33]		Species or species habitat may occur within area
Balaenoptera borealis Sei Whale [34]	Vulnerable	Species or species habitat likely to occur within area
Balaenoptera edeni Bryde's Whale [35]		Species or species habitat may occur within area
Balaenoptera musculus Blue Whale [36]	Endangered	Species or species habitat likely to occur within area
Balaenoptera physalus Fin Whale [37]	Vulnerable	Species or species habitat likely to occur within area
Delphinus delphis Common Dolphin, Short-beaked Common Dolphin [60]		Species or species habitat may occur within area

Name	Status	Type of Presence
Feresa attenuata Pygmy Killer Whale [61]		Species or species habitat may occur within area
Globicephala macrorhynchus Short-finned Pilot Whale [62]		Species or species habitat may occur within area
Grampus griseus Risso's Dolphin, Grampus [64]		Species or species habitat may occur within area
Kogia breviceps Pygmy Sperm Whale [57]		Species or species habitat may occur within area
Kogia simus Dwarf Sperm Whale [58]		Species or species habitat may occur within area
Lagenodelphis hosei Fraser's Dolphin, Sarawak Dolphin [41]		Species or species habitat may occur within area
Megaptera novaeangliae Humpback Whale [38]	Vulnerable	Species or species habitat known to occur within area
Mesoplodon densirostris Blainville's Beaked Whale, Dense-beaked Whale [74]		Species or species habitat may occur within area
Orcinus orca Killer Whale, Orca [46]		Species or species 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 Indian Ocean Bottlenose Dolphin, Spotted Bottlenose Dolphin [68418]		Species or species habitat may occur within area
Tursiops aduncus (Arafura/Timor Sea populations) Spotted Bottlenose Dolphin (Arafura/Timor Sea populations) [78900]		Species or species habitat may occur within area

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

Extra Information

Caveat

The information presented in this report has been provided by a range of data sources as acknowledged at the end of the report.

This report is designed to assist in identifying the locations of places which may be relevant in determining obligations under the Environment Protection and Biodiversity Conservation Act 1999. It holds mapped locations of World and National Heritage properties, Wetlands of International and National Importance, Commonwealth and State/Territory reserves, listed threatened, migratory and marine species and listed threatened ecological communities. Mapping of Commonwealth land is not complete at this stage. Maps have been collated from a range of sources at various resolutions.

Not all species listed under the EPBC Act have been mapped (see below) and therefore a report is a general guide only. Where available data supports mapping, the type of presence that can be determined from the data is indicated in general terms. People using this information in making a referral may need to consider the qualifications below and may need to seek and consider other information sources.

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

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

Where very little information is available for species or large number of maps are required in a short time-frame, maps are derived either from 0.04 or 0.02 decimal degree cells; by an automated process using polygon capture techniques (static two kilometre grid cells, alpha-hull and convex hull); or captured manually or by using topographic features (national park boundaries, islands, etc). In the early stages of the distribution mapping process (1999-early 2000s) distributions were defined by degree blocks, 100K or 250K map sheets to rapidly create distribution maps. More reliable distribution mapping methods are used to update these distributions as time permits.

Only selected species covered by the following provisions of the EPBC Act have been mapped:

- migratory and
- marine

The following species and ecological communities have not been mapped and do not appear in reports produced from this database:

- threatened species listed as extinct or considered as vagrants
- some species and ecological communities that have only recently been listed
- some terrestrial species that overfly the Commonwealth marine area
- migratory species that are very widespread, vagrant, or only occur in small numbers

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

- non-threatened seabirds which have only been mapped for recorded breeding sites
- seals which have only been mapped for breeding sites near the Australian continent

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

Coordinates

-20.89605 114.91702,-20.8971 114.91809,-20.89842 114.91904,-20.89989 114.91975,-20.90133 114.92015,-20.90244 114.9213,-20.90384 114.9223,-20.90535 114.923,-20.90714 114.92345,-20.90862 114.92354,-20.91012 114.92337,-20.91155 114.92294,-20.9128 114.92233,-20.9148 114.92264,-20.91681 114.92247,-20.91889 114.92176,-20.9207 114.92059,-20.92216 114.91911,-20.92318 114.91755,-20.92393 114.91569,-20.92431 114.91368,-20.9285 114.91026,-20.95785 114.879,-20.95995 114.87762,-20.9618 114.87559,-20.96264 114.87415,-20.96321 114.87267,-20.96358 114.87095,-20.96369 114.86926,-20.96356 114.86711,-20.96322 114.86548,-20.96259 114.86385,-20.96166 114.86234,-20.96049 114.86104,-20.95917 114.86003,-20.95774 114.8593,-20.95613 114.85882,-20.95456 114.85867,-20.9527 114.85884,-20.95105 114.85932,-20.9496 114.86007,-20.94793 114.86143,-20.94675 114.86288,-20.92535 114.88502,-20.92408 114.88353,-20.9226 114.88238,-20.92082 114.88151,-20.9191 114.88107,-20.91714 114.881,-20.91537 114.88132,-20.91362 114.88205,-20.91207 114.88311,-20.91057 114.88468,-20.90949 114.88646,-20.90874 114.88858,-20.90845 114.89079,-20.90652 114.89197,-20.90507 114.89185,-20.90359 114.89199,-20.90209 114.8924,-20.90085 114.89298,-20.89957 114.89385,-20.89844 114.89492,-20.89753 114.89609,-20.89681 114.89738,-20.89629 114.89872,-20.89598 114.90011,-20.89586 114.9016,-20.89592 114.90285,-20.89498 114.90432,-20.8943 114.906,-20.89396 114.90751,-20.89372 114.91014,-20.89384 114.91211,-20.89429 114.91391,-20.89507 114.91561,-20.89605 114.91702

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.

Department of Agriculture Water and the Environment
GPO Box 858
Canberra City ACT 2601 Australia
+61 2 6274 1111

APPENDIX C:

STAKEHOLDER CONSULTATION BULLETINS

<table>
<tr><th>Stakeholder</th><th>Consultation Bulletins</th></tr>
<tr><td>AFMA

AHO

AMSA

DBCA

DoD

DoT

DoAWE

DMIRS

DPIRD

Commonwealth Fisheries Association

Raptis and Sons

Recfishwest

Westmore Seafoods (Seafresh Holdings)

Pearl Producers Association (PPA)</td><td>
24.03.2021 – Email update sent
Dear Sir/Madam
Further to my email dated 9 March 2021 Eni have updated their decommissioning strategy and would like to inform you of one additional piece of infrastructure that is proposed to be decommissioned in situ, the Corkybark wellhead.
The Corkybark well is an abandoned exploration well, located within the Woollybutt field at the following coordinates:
<table>
<tr><td>Eastings</td><td>Northings</td><td>Longitude</td><td>Latitude</td></tr>
<tr><td>289233</td><td>7688393</td><td>114.9736806</td><td>-20.8928668</td></tr>
</table>
The figure showing the location of the Woollybutt field is attached.
In 2000 Eni attempted to remove the wellhead, however due to technical and safety issues the wellhead could not be completely removed. The portion of the wellhead that was unable to be removed remains on the seabed, extending up to 1.3m in height. The wellhead is comprised entirely of steel and does not contain any operational fluids or plastics. A photo showing the Corkybark wellhead is also attached.
As part of Eni’s strategy for decommissioning the Woollybutt field, they are seeking approval from NOPSEMA to leave Corkybark wellhead in situ. The potential impacts from this are detailed in the table below:
<table>
<tr><td>Environmental Risk and/or Impact</td><td>Risk Description</td></tr>
<tr><td>Interaction with other marine users</td><td>Leaving the Corkybark wellhead in situ will result in a long term physical presence on the seabed. This has potential to interact with other marine users, particularly those who have activities that also interact with the seabed.
These potential impacts will be assessed in the EP and will include mitigation measures such as long term identification of infrastructure on marine charts.</td></tr>
<tr><td>Discharge of material to the marine environment</td><td>Long term degradation of the Corkybark wellhead may occur.
As the wellhead corrodes and degrades the constituents making up the wellhead will be released to the environment. Iron, the main consistent of wellheads (about 98%) is not considered a significant contaminate in the marine environment. Other constituents represent less than 2% of the wellhead’s composition and impacts to marine environment from these is extremely low.
Degradation modelling of the wellhead has shown that it could take up to 250 years to corrode.
The EP will assess the potential impacts to the marine environment from the breakdown of materials.</td></tr>
<tr><td>Benefits to benthic habitats</td><td>Observations of the Woollybutt infrastructure indicate that benthic habitat has become established. This is expected to provide ongoing benefits to benthic habitats in the Woollybutt field area.
Fish habitat studies are underway to quantify the benefit that the long term presence of the subsea</td></tr>
</table>
</td></tr>
</table>

Stakeholder	Consultation Bulletins

	infrastructure may have on benthic habitats and an assessment of this will be provided in the EP.

Eni are now also seeking your feedback on the Corkybark wellhead being left in situ in addition to the infrastructure already communicated in previous correspondence, being:

- DSPM anchors and chains
- Umbilicals and umbilical jumpers
- Flexible and reinjection flowlines and jumpers
- Umbilical crossing mattresses

Our original correspondence sought feedback by the 31st March 2021, however we have now extended this to the 16th April 2021 to allow for this additional information to be considered.

Thanks

09.03.2021 - Consultation letter emailed (OPS.LT.6416.SD v2)

Stakeholder Consultation

Woollybutt Field Decommissioning – Stakeholder Consultation

Introduction

Eni Australia Limited (Eni) is currently planning for the decommissioning of the Woollybutt field, located in Production Licence WA-25-L. The Woollybutt field is in approximately 100 m of water, located within Commonwealth waters 65 km north of Onslow and 35 km west of Barrow Island (Attachment 1).

Decommissioning activities are planned in three stages, summarised below with the associated environmental permissioning documents:

Activity	Permissioning document	Status
1. Plug and abandonment of wells	P&A and Equipment Removal EP	Under preparation
2. Removal of the majority of Woollybutt subsea infrastructure		
3. Leaving of the remaining subsea infrastructure in situ	Decommissioning EP	Under preparation – subject of this consultation bulletin

This decommissioning strategy has been selected by Eni following comparative assessment of all decommissioning options. The assessment found that leaving certain elements of the subsea infrastructure in situ provided better environmental, technical and safety outcomes than complete removal, partly due to the presence of subsea habitats that have formed on the infrastructure since it was first installed.

Eni are now preparing an Environment Plan (EP) for submission to the National Offshore Petroleum Safety and Environmental Management Authority (NOPSEMA) covering this remaining subsea infrastructure (**Decommissioning EP**).

Background

Woollybutt oil production ceased in 2012 and all associated subsea infrastructure has remained in situ while decommissioning activities were planned for.

Field maintenance and management activities have been ongoing since 2012 in accordance with a long standing EP, which was last revised and accepted in 2019. This **P&A and Equipment Removal EP** also covers plug and abandonment (P&A) activities and is currently being revised to include the removal of the majority of the Woollybutt field subsea infrastructure including:

- Wellheads and xmas trees
- Subsea manifolds
- Subsea umbilical termination units
- Umbilical termination assembly
- Control distribution unit
- Disconnectable single point mooring (DSPM) excluding anchors and chains
- Anode skids
- Flowline transition guide base.

Stakeholder	Consultation Bulletins

In accordance with consultation material provided in 2019, the well plug and abandonment activities are due to commence in Quarter 3 2021, with removal of the majority of the subsea infrastructure including that listed above to follow, pending NOPSEMA acceptance of the revised EP.

Remaining Subsea Infrastructure covered by the Decommissioning EP

The following subsea infrastructure is proposed to be decommissioned under the Decommissioning EP:

- DSPM anchors and chains
- Umbilical crossing mattresses
- Umbilicals and umbilical jumpers
- Flexible and reinjection flowlines and jumpers.

A summary of this infrastructure is provided in Table 1. Attachment 2 shows figures of all Woollybutt infrastructure, including the components listed in Table 1 and the components that will be removed under the Plug, Abandonment and Removal EP.

Table 1: Summary of Subsea Infrastructure covered by the Decommissioning EP

Infrastructure	Description
DSPM anchors and chains	Six (6) anchors weighing approximately 35 Te each, and six (6) anchor chains
Umbilical crossing mattresses	Eight (8) umbilical crossing mattresses
Umbilicals and umbilical jumpers	Ten (10) umbilicals and umbilical jumpers up to approximately 5.8 km in length
Flexible and reinjection flowlines and jumpers.	Four (4) flowlines 2-1/2 inch to 6 inch and 1700 to 5750 m in length. Four (4) jumpers 2-1/2 inch to 6 inch and 17 to 50 m Four (4) risers 6 inch and 2-1/2 inch 1035 to 1045 m in length

Activities

Activities undertaken as part of the scope of the Decommissioning EP are presented in Table 2.

Table 2: Summary of Activities in scope of Decommissioning EP

Activity	Summary	Frequency and duration
Permanent decommissioning in situ	All subsea infrastructure within the scope of this EP is proposed to be decommissioned in situ. No vessel activities or removal activities are within the scope of this EP. All infrastructure has been flushed and cleaned under separate EPs.	Not applicable, no infield activities planned

Comparative assessment

A comparative assessment process was undertaken to inform the decommissioning activities. This included evaluation of a range of decommissioning options for the Woollybutt infrastructure, including complete removal, partial removal and leave in situ the remaining subsea equipment. Options were assessed with respect to technical, health and safety, environmental, economic and socioeconomic risks.

The assessment has determined that leaving the remaining components in situ would provide the best overall outcome. In particular, the equipment would continue to provide hard substrate for marine habitat growth on an otherwise featureless seabed.

Eni have commissioned studies to inform and support the leave in situ decommissioning option for certain remaining subsea infrastructure, including

- Degradation studies that assess how the infrastructure will react in the marine environment and to understand potential long term impacts; and
- Fish habitat studies to assess the habitat supported by the remaining Woollybutt field infrastructure and to inform the assessment of long term benefits to benthic habitats.

<table>
<tr><th>Stakeholder</th><th>Consultation Bulletins</th></tr>
<tr><td></td><td>
The preliminary findings of these studies will be available in the Decommissioning EP submitted to NOPSEMA.

Environmental Management

Eni assessed the environmental risk assessment for the proposed decommissioning activities, giving consideration to activity timing, durations, location and potential environmental impacts. Management measures will be implemented to reduce the impacts and risks to as low as reasonably practicable and to an acceptable level.

Table 3 provides a summary of potential key environmental risk and/or impacts an associated management measures identified.

Table 3: Potential Key Environmental Risks and Management Measures
<table>
<tr><th>Environmental Risk and/or Impact</th><th>Risk Description</th></tr>
<tr><td>Interaction with other marine users</td><td>Leaving certain subsea infrastructure in situ will result in a long term physical presence on the seabed. This has potential to interact with other marine users, particularly those who have activities that also interact with the seabed.

These potential impacts will be assessed in the decommissioning EP and will include mitigation measures such as long term identification of infrastructure on marine charts.</td></tr>
<tr><td>Discharge of material to the marine environment</td><td>Long term degradation of subsea infrastructure may occur. The extent of this will be informed by degradation studies that are currently being undertaken.

The Decommissioning EP will assess the potential impacts to the marine environment from the breakdown of materials.</td></tr>
<tr><td>Benefits to benthic habitats</td><td>Observations of the Woollybutt infrastructure indicate that benthic habitat has become established. This is expected to provide ongoing benefits to benthic habitats in the Woollybutt field area.

Fish habitat studies are underway to quantify the benefit that the long term presence of the subsea infrastructure may have on benthic habitats and an assessment of this will be provided in the Decommissioning EP.</td></tr>
</table>
Stakeholder Comment and Feedback

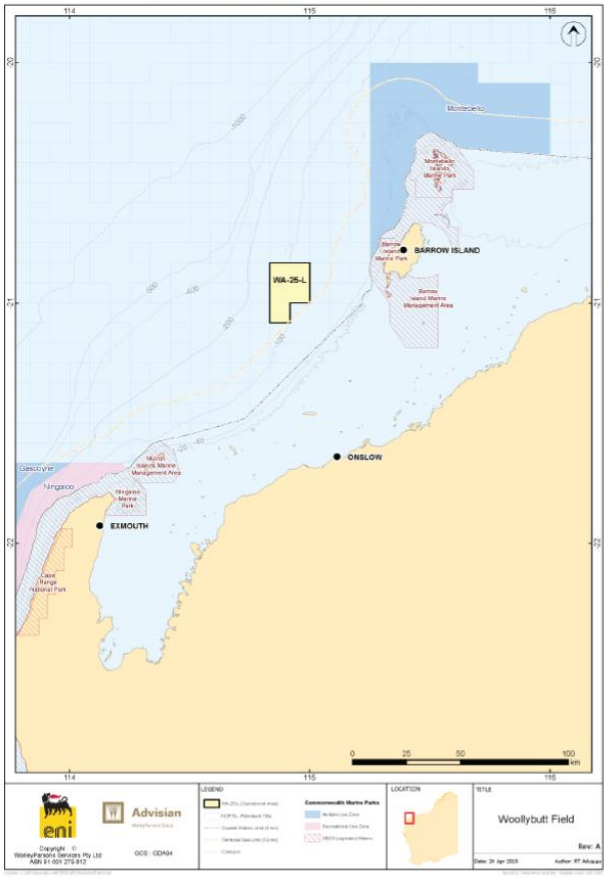
Your comment is south in relation to any potential impact that the proposed decommissioning activities, covered by the Decommissioning EP, may have on your functions, interests or activities. If you wish to provide any feedback on these activities, please do so by 31 March 2021 to the contact details provided below.

All comments provided will be considered in the Decommissioning EP to be submitted to NOPSEMA, in accordance with the OPGGS Act.

All communications in relation to this should be directed to:
[redacted]
[redacted]
[redacted]
[redacted]
</td></tr>
</table>

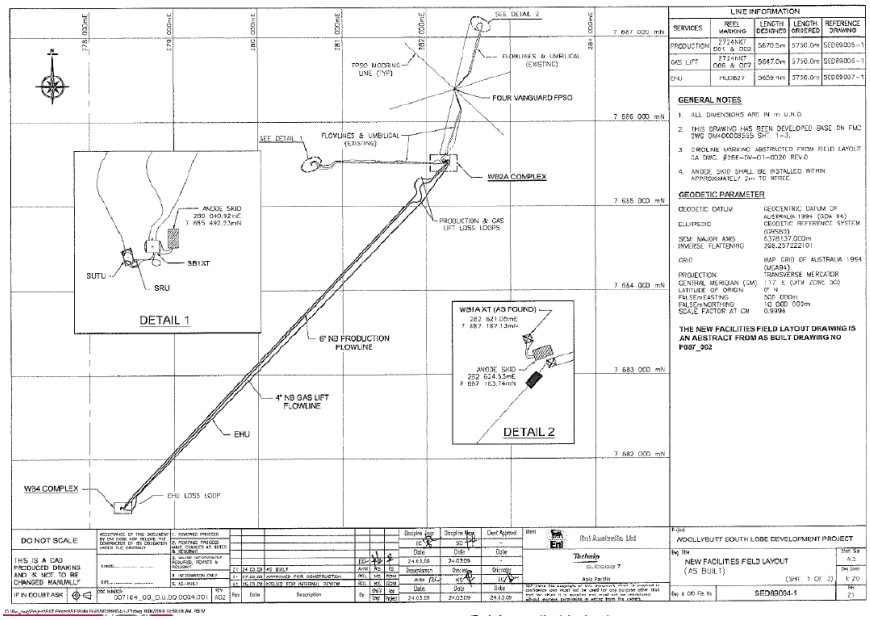
Stakeholder	Consultation Bulletins

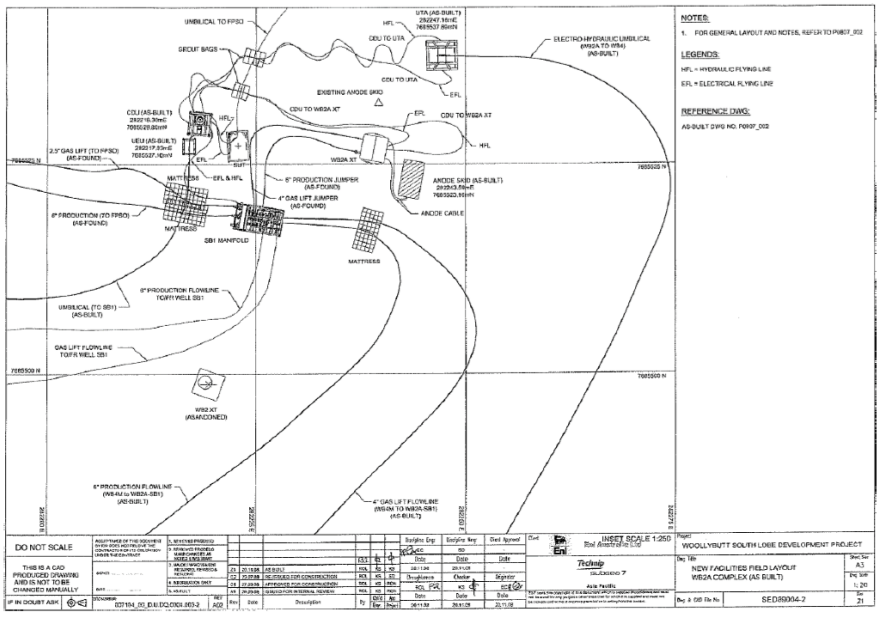
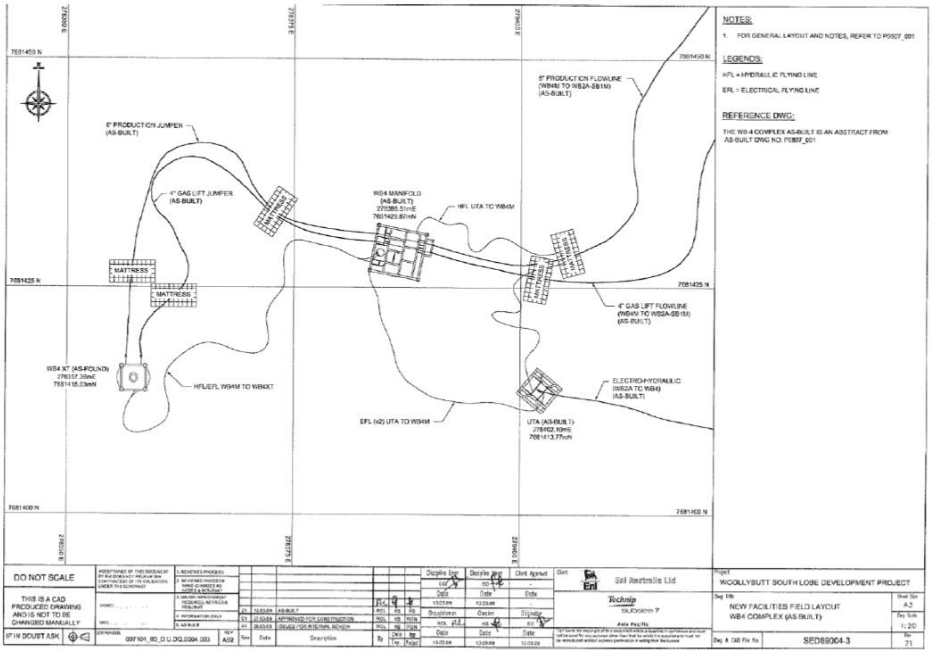
Attachment 1: Location of WA-25 L



Attachment 2: Woollybutt field layout

Figure 1 of 3



Stakeholder	Consultation Bulletins
	Figure 2 of 3  **Figure 3 of 3** 

Stakeholder	Consultation Bulletins

25.09.2020 –Consultation letter emailed (OPS.LT.6230.SD)

Stakeholder Consultation

Eni Australia Limited (Eni) is currently undertaking ongoing field management activities within the Woollybutt field, located in Production Licence WA-25-L within Commonwealth waters. Woollybutt production ceased in 2012 and all associated subsea equipment remains in the Woollybutt field and within a 500 m Petroleum Safety Zone (PSZ).

Eni has an Environment Plan (EP) in place for the current ongoing field management activities, which was accepted by the National Offshore Petroleum Safety and Environmental Management Authority (NOPSEMA) in 2019.

Eni is submitting a revised EP to NOPSEMA for acceptance in accordance with the Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2009 (Cth) (the regulations) to reflect the current status of the subsea field infrastructure, the proposed P&A activities and the proposed recovery of certain subsea production equipment.

Consultation material provided in 2015, 2016 and 2019 has kept stakeholders informed regarding the status of the Woollybutt field and future plans. This consultation bulletin provides an update on ongoing field management, field status and proposed plug and abandonment (P&A) and equipment recovery activities.

Current status of equipment

In January 2020, during visual inspection by a remotely operated vehicle (ROV), the Woollybutt Disconnectable Single Point Mooring (DSPM) was noted to have sunk to the seabed from its previous location at 35 m water depth due to a buoyancy failure.

In August 2020, one mid-depth buoy (MDB) was noted to have risen to the sea surface from its previous location at 50 m water depth, due to tether failure.

The floating buoy remains stationary within the 500 m Petroleum Safety Zone and is under 24-hour surveillance by a dedicated vessel on location. Inspection confirms there is no evidence of hydrocarbon release. At the time of writing, remediation planning is ongoing to remove the hazard.

All other subsea production equipment, including the second MDB, remains in place within the Woollybutt Field 500 m PSZ.

Location

The Woollybutt field is located in production license WA-25-L in approximately 100 m of water, 65 km north of Onslow and 35 km west of Barrow Island (Attachment 1) within Commonwealth waters. A summary of the key field infrastructure, locations and status are provided in Table 1.

The Woollybutt field subsea infrastructure are marked on nautical charts surrounded by a 500 m Petroleum Safety Zone (PSZ), which excludes other marine users from the area (Attachment 2).

Table 1: Summary of the Key Woollybutt Infrastructure

Infrastructure	Longitude	Latitude	Status
Scallybutt-1 well (SB1)	114 53.447	-20 55.078	Shut-in production wells to be P&A.
Woollybutt-4 well (WB4)	114 52.102	-20 53.27	
Woollybutt-2A well (WB2A)	114 54.373	-20 55.069	
Woollybutt-1 well (WB1)	114 54.524	-20 54.266	
Woollybutt-3A (WB3A)	114 52.406	-20 58.043	Suspended wells – may be included in P&A campaign.
Woollybutt-5A (WB5A)	114 51.703	-21 00.000	

Disconnectable Single Point Mooring (DSPM)	114 54.441	-20 54.599	The DSPM is currently located on the seabed, located within the 500 m PSZ.
Mid-depth buoy (north), chains and gravity base	114 54.450	-20 54.582	The northern mid-depth buoy is currently floating on the sea surface within the 500 m PSZ and is under 24-hour surveillance.
Mid-depth buoy (south), chains and gravity base	114 54.444	-20 54.646	The southern mid-depth buoy remains in place at 50 m water depth.

Activities

The revised EP includes activities relating to the field management, well plug and abandonment (P&A) activities and recovery of certain subsea production equipment.

Activities undertaken as part of the scope of the revised EP are presented in Table 2.

Table 2: Summary of Activities

Activity	Summary	Frequency and duration
Field Management	Use of remotely operated vehicles (ROV) deployed from a vessel to perform field management scopes, including: • Cathodic Protection (CP) surveys; • General Visual Inspections (GVI); • Inspection, monitoring, maintenance and repair (IMMR).	On an ongoing basis, as per the Eni Integrity Management Plan (IMP) strategy. Typically undertaken in 7-14 days.
P&A	Mobilisation of an Intervention Vessel (IV) to the field with integrated services to perform well P&A on four to six wells. Logistical support is provided by up to three offshore support vessels and helicopter services. Well P&A activities will include the setting of plugs and cement barriers at specified depths in the wells to act as permanent barriers to eliminate the possibility of potential hydrocarbon exposure to the environment. Following plugging, wellheads will be cut at the seabed and retrieved.	Target execution window is 2Q 2021 – 2Q 2022[1]. It is anticipated P&A of each well will take approximately 10-20 days.
Recovery of subsea production equipment	The recovery of subsea production equipment will be undertaken using the IV and support vessels. The following equipment is proposed to be recovered from the field and taken to shore for disposal, recycling or reuse, in accordance with applicable legislation: • Mid-depth buoys, chains/tether and gravity bases; • Disconnectable Single Point Mooring; • Subsea structures (including manifolds and umbilical termination assemblies). During the activity, anchors, chains, flowlines and umbilicals will be disconnected, and remain in situ until future decommissioning.	Target execution window for mid-depth buoy removal is Q4 2020[1]. Removal of DSPM and listed subsea structures to follow the P&A campaign and anticipated to take approximately 20-30 days.

Stakeholder	Consultation Bulletins

Note 1: subject to project variables including but not limited to vessel availability, regulatory approvals and weather.

Environmental Management

Eni assessed the environmental risk assessment for the ongoing field management, proposed P&A activities and removal of subsea production equipment, giving consideration to activity timing, durations, location and potential environmental impacts. Management measures will be implemented to reduce the impacts and risks to as low as reasonably practicable and to an acceptable level.

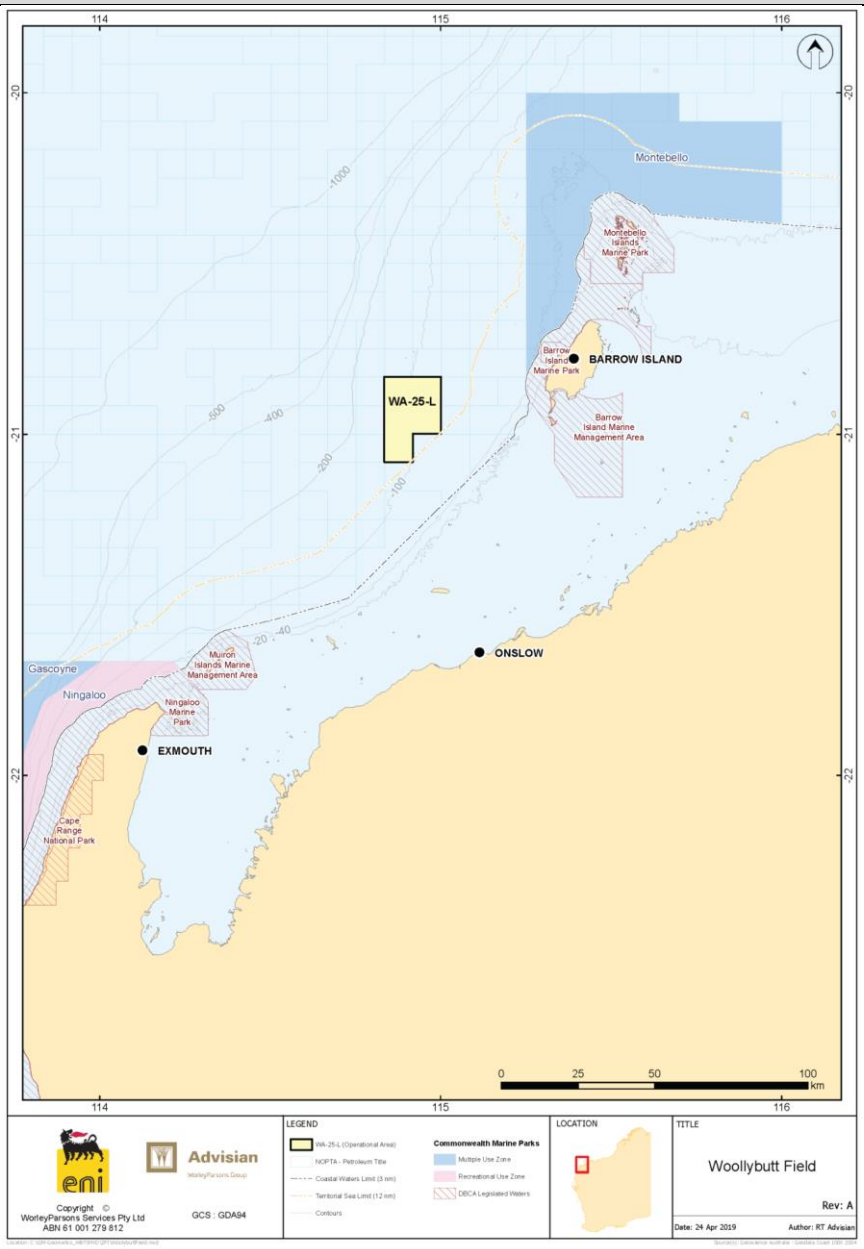
Table 3 provides a summary of potential key environmental risk and/or impacts and associated management measures identified.

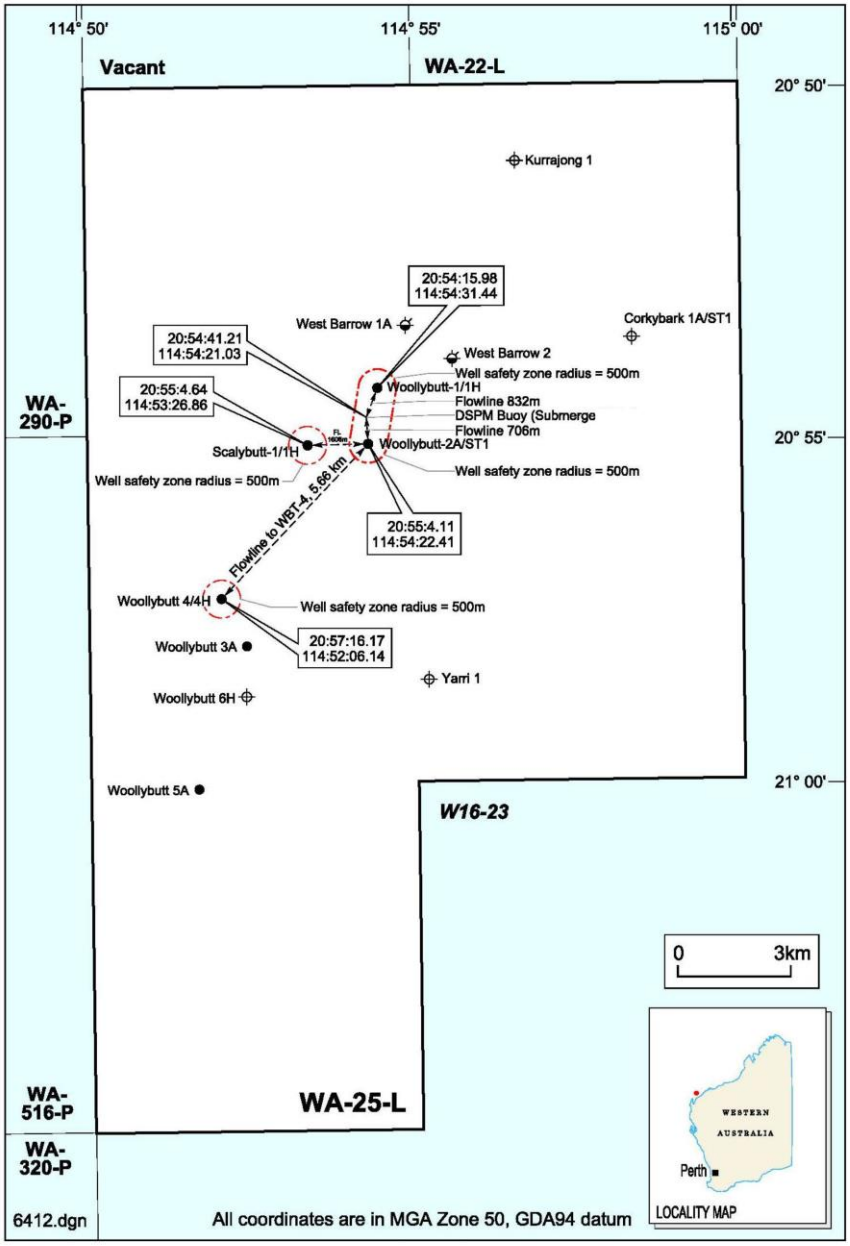
Table 3: Potential Key Environmental Risks and Management Measures

Environmental Risk and/or Impact	Risk Description	Mitigation and/or Management Measure
Interaction with other users – vessels and subsea equipment	Presence of vessels and the 500 m PSZ in the field may exclude other marine users from the area.	Eni will notify regulatory authorities and marine users on the activities as required.
Routine marine discharges	Vessels will discharge water, cooling water and sewage/grey water to the marine environment.	All routine marine discharges will be managed according to legislative requirements.
Chemical use / discharge	Minor quantities of chemicals will be released to the marine environment during field management, P&A and recovery of subsea equipment.	Chemical use will be managed in accordance with an environmental selection process.
Seabed disturbance	Removal of subsea infrastructure will disturb the area in which the equipment was once placed.	Procedures will be followed to limit seabed disturbance during recovery of subsea equipment.
Floating mid-depth buoy interaction with other users	Movement of the floating mid-depth buoy outside of the 500 m PSZ could present a navigational hazard to other users.	The floating mid-depth buoy is under 24-hour surveillance and will be removed and disposed of onshore in accordance with legislative requirements.
Marine fauna interaction	Vessels used for the activities have the potential to interact with marine fauna (e.g. collisions).	Measures will be taken to protect marine fauna from vessel activities.
Loss of containment	Loss of containment of hydrocarbons to the marine environment may occur during refuelling at sea or in the event of a vessel collision or a loss of well control / well leak.	Appropriate fuel transfer procedures and equipment will be used to prevent spills Procedures to reduce the potential for uncontrolled hydrocarbon releases will be followed. Response plans and equipment will be in place and maintained to manage spills to the environment.
Introduction of marine pest species	Introduction and establishment of invasive marine pests to the area via vessels ballast water or biofouling on vessel hulls.	All vessels will be assessed and managed as appropriate to prevent the introduction of marine pests. Vessels will comply with biosecurity requirements.

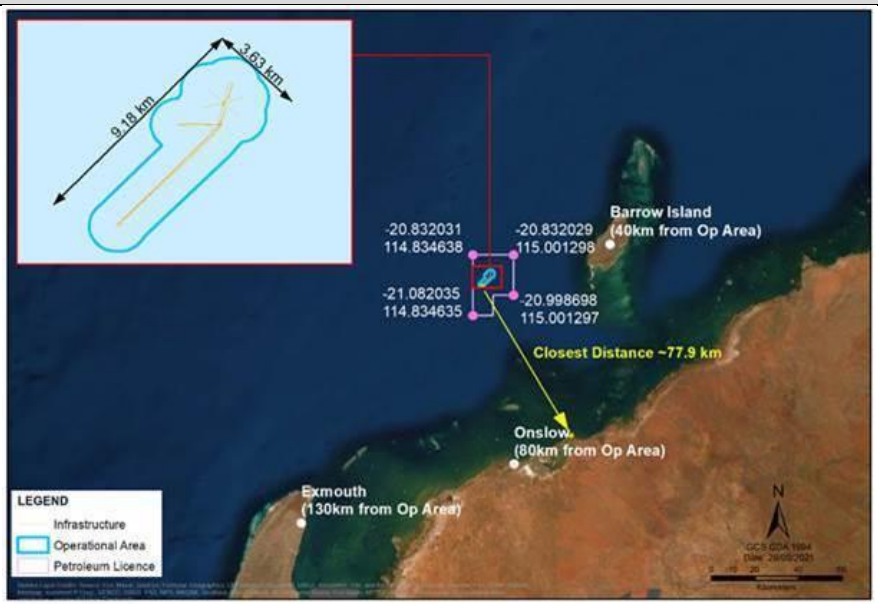
Future Decommissioning

Stakeholder	Consultation Bulletins
	Decommissioning of the remaining Woollybutt field subsea components (anchors, chains, four non-production well heads, flowlines and umbilicals) will be subject of a separate EP. Until decommissioning, field management will be ongoing to maintain remaining components in accordance with Section 572 of the Offshore Petroleum and Greenhouse Gas Storage Act (OPGGS Act). Remaining flowlines range from 2½" to 6" in diameter and approximately 20 km in total length, and umbilicals are 3½" in diameter and approximately 8 km in total length. A comparative assessment process has been undertaken to evaluate a range of decommissioning options for the remaining components, including complete removal, partial removal and leave insitu. Options were assessed with respect to technical, health and safety, environmental, economic and socioeconomic risks. The assessment has determined that leaving the remaining components insitu would provide the best overall outcome. In particular, the equipment would continue to provide hard substrate for marine habitat growth on an otherwise featureless seabed. Studies are ongoing and stakeholder feedback will be taken into consideration. **Stakeholder Comment and Feedback** Your comment is sought in relation to any potential impact that the ongoing field management, proposed well P&A activities and recovery of subsea production equipment may have on your functions, interests or activities. If you wish to provide any feedback on these activities, please do so by 26 October 2020 to the contact details provided below. Eni also seeks any comment from stakeholders regarding insitu decommissioning of remaining subsea components, and whether they would like to continue to be consulted in these matters as the decommissioning EP is developed. All comments provided will be considered in the respective revision of Eni's Woollybutt EP to be submitted to NOPSEMA, in accordance with the OPGGS Act. All communications in relation to this should be directed to: [redacted]

Stakeholder	Consultation Bulletins
	 **Attachment 1: Location of WA-25 L**

Stakeholder	Consultation Bulletins
	 **Attachment 2: Woollybutt Field 500m Petroleum Safety Zone**
Commonwealth Fisheries Association **Pearl Producers Association (PPA)**	**01.04.2021 – Email sent** *On behalf of Eni, WAFIC provided the following email correspondence to fishing industry organisations.* Dear [redacted] Eni Australia Limited (Eni) is currently planning and working on the decommissioning of the Woollybutt field, Eni is seeking your feedback as a stakeholder and peak body. This information has been sent to Ray Davies, the active Western Tuna and Billfish operator in this area, ASBTIA and the CFA. Please find in the attached fact sheet more information on the project activities. The focus of this consultation is the permanent abandonment of some infrastructure on the sea floor, for which a new environment plan (EP) titled 'Woollybutt Field Decommissioning EP' is being prepared (referred hereafter as the Decommissioning EP). **Location**: Approximately 80 km north of Onslow and 40 km west of Barrow Island.

Stakeholder	Consultation Bulletins



Water Depth: Approximately 100 m.

Previous Activity Update:

- Plug and abandon all wells and remove a large amount of the site infrastructure planned for Q3 2021-2022.
- These activities have been previously communicated to you and the relevant EP is currently with NOPSEMA for assessment.

Activity Overview – Decommissioning EP:

The remaining Woollybutt infrastructure is planned to be decommissioned in situ (permanently left as is on the sea floor) and will be covered under the Decommissioning EP. It is the retiring of the remaining infrastructure and leaving this on site that Eni is specifically seeking your feedback on.

The Decommissioning EP involves zero activity at the Woollybutt site.

The infrastructure that is proposed to be left in situ includes:

- Disconnectable single point mooring anchors and chains
- Umbilical crossing mattresses
- Umbilicals and umbilical jumpers
- Flexible and reinjection flowlines and jumpers
- Corkybark wellhead

Potential impacts to commercial fishers:

The attached factsheet contains further information on the decommissioning activities as well as more information on each of the points below:

- The remaining infrastructure will be between 0.3m and 1m above the seabed with the Corkybark wellhead being the highest piece of infrastructure.
  - Potential snag hazard
- This infrastructure provides benthic habitat.
  - Fish aggregation site
  - See sub-sea photos in the attached fact sheet
- Eni have commissioned fish habitat surveys, preliminary results have identified habitat for the following commercial species: E. areolatus (Aerolate Grouper), L. malabaricus (Saddletail Snapper) and G. buergeri (Northern Pearl Perch).
- Eni have commissioned degradation studies to understand how the left behind infrastructure will react in the marine environment following decommissioning.
  - Made predominantly of steel and plastic, it is expected that the plastics will take 1,000 to10,000 years to degrade
  - 60% to 90% of the infrastructure is expected to self-bury within 30 years of decommissioning, which will mean some plastics will remain buried whilst others will over time enter the marine environment as microplastics and macroplastics
  - Long term degradation of subsea infrastructure may occur, especially micro and macro plastic
  - The Decommissioning EP will assess the potential impacts to the marine environment, marine mammals and key indicator species from the breakdown of these plastic and other materials

Stakeholder	Consultation Bulletins
	Exclusion Zones: • All prior petroleum safety exclusion zones will be removed from the Woollybutt site. • All remaining infrastructure will remain marked on navigation charts. WAFIC is sending this information out (via a blind email) on a fee-for-service basis on behalf of Eni to ensure peak bodies and commercial fishing license holders receive this in a timely manner via an accurate list. Eni needs your feedback. If you have any additional queries please contact [redacted] directly (on behalf of Eni) via: [redacted] or [redacted]. Best regards [redacted]
WAFIC	**06.04.2021 – Email sent** Dear WAFIC As previously discussed, Eni Australia Limited (Eni) is currently planning and working on the decommissioning of the Woollybutt field, Eni is seeking your feedback as a stakeholder and potentially affected party with interests in this area. Please find in the attached fact sheet more information on the project activities. The focus of this consultation is the permanent abandonment of some infrastructure on the sea floor, for which a new environment plan (EP) titled 'Woollybutt Field Decommissioning EP' is being prepared (referred hereafter as the Decommissioning EP). **Location:** Approximately 80 km north of Onslow and 40 km west of Barrow Island. **Water Depth**: Approximately 100 m. **Previous Activity Update:** • Plug and abandon all wells and remove a large amount of the site infrastructure planned for Q3 2021-2022. • These activities have been previously communicated to you and the relevant EP is currently with NOPSEMA for assessment. **Activity Overview – Decommissioning EP:** The remaining Woollybutt infrastructure is planned to be decommissioned in situ (permanently left as is on the sea floor) and will be covered under the Decommissioning EP. It is the retiring of the remaining infrastructure and leaving this on site that Eni is specifically seeking your feedback on. The Decommissioning EP involves zero activity at the Woollybutt site. The infrastructure that is proposed to be left in situ includes: • Disconnectable single point mooring anchors and chains • Umbilical crossing mattresses • Umbilicals and umbilical jumpers • Flexible and reinjection flowlines and jumpers • Corkybark wellhead **Potential impacts to commercial fishers:** The attached factsheet contains further information on the decommissioning activities as well as more information on each of the points below: • The remaining infrastructure will be between 0.3m and 1m above the seabed with the Corkybark wellhead being the highest piece of infrastructure. o Potential snag hazard • This infrastructure provides benthic habitat. o Fish aggregation site o See sub-sea photos in the attached fact sheet • Eni have commissioned fish habitat surveys, preliminary results have identified habitat for the following commercial species: E. areolatus (Aerolate Grouper), L. malabaricus (Saddletail Snapper) and G. buergeri (Northern Pearl Perch). • Eni have commissioned degradation studies to understand how the left behind infrastructure will react in the marine environment following decommissioning. o Made predominantly of steel and plastic, it is expected that the plastics will take 1,000 to10,000 years to degrade o 60% to 90% of the infrastructure is expected to self-bury within 30 years of decommissioning, which will mean some plastics will remain buried whilst others will over time enter the marine environment as microplastics and macroplastics

Stakeholder	Consultation Bulletins

- Long term degradation of subsea infrastructure may occur, especially micro and macro plastic
- The Decommissioning EP will assess the potential impacts to the marine environment, marine mammals and key indicator species from the breakdown of these plastic and other materials

Exclusion Zones:

- All prior petroleum safety exclusion zones will be removed from the Woollybutt site.
- All remaining infrastructure will remain marked on navigation charts.

Please provide your feedback directly to [redacted] (on behalf of Eni) via [redacted] by 30 April 2021.

Best regards

[redacted]

Attachment:

Woollybutt Field Decommissioning Environment Plan (EP) Commercial Fishing Stakeholder Consultation

Introduction

Eni Australia Limited (Eni) is currently planning the decommissioning of the Woollybutt field in Production Licence WA-25-L.

This involves the preparation of the Woollybutt Field Decommissioning Environment Plan (EP) to be submitted to the National Offshore Petroleum Safety and Environmental Management Authority (NOPSEMA) covering the subsea infrastructure that remains in the Woollybutt Field – referred in this document as the Decommissioning EP.

Eni seeks to engage directly with the commercial fishing sector and looks forward to your comment and input regarding Eni's final plans for the decommissioning of the Woollybutt Field.

The Woollybutt field is 65 km north of Onslow and 35 km west of Barrow Island, in approximately 100 m water depth. See map on page 6. Decommissioning activities are planned in three stages, summarised below:

Activity	Key Approval Document	Status
1. Plug and abandonment (P&A) of wells	P&A and Equipment Removal EP	Consultation done, EP assessment in process.
2. Removal of the majority of Woollybutt subsea infrastructure		
3. Leaving of the remaining subsea infrastructure in situ.	Decommissioning EP	EP under preparation – subject of this consultation

Activity 1 and Activity 2 noted above covers the physical infrastructure removal activities for the Woollybutt site and is going through the NOPSEMA approval process through a separate EP.

The Decommissioning EP involves zero activity on site. Eni is seeking NOPSEMA acceptance of the Decommissioning EP which involves leaving all remaining infrastructure in situ (ie left as is).

The decommissioning strategy has been selected by Eni following comparative assessment of all decommissioning options. The assessment found that leaving certain elements of the subsea infrastructure in situ provided better environmental, technical and safety outcomes than complete removal, partly due to the presence of subsea habitats that have formed on the infrastructure since it was first installed.

Background

Woollybutt oil production ceased in 2012 and all associated subsea infrastructure has remained in situ while decommissioning activities were planned for.

Since production ceased, field maintenance and management activities have been ongoing in accordance with a long standing EP, which was last revised and accepted in 2019 (https://info.nopsema.gov.au/activities/28/show_public).

Diagrams of the Woollybutt infrastructure field Figures 1 – 3 are on pages 7 - 9.

Stakeholder	Consultation Bulletins
	This **P&A and Equipment Removal EP** also covers plug and abandonment (P&A) activities and is currently being revised to include the complete removal of the majority of the Woollybutt field subsea infrastructure including: • Wellheads and Xmas trees (except the Corkybark wellhead, which will be left in situ) • Subsea manifolds • Subsea umbilical termination units • Umbilical termination assembly • Control distribution unit • Disconnectable single point mooring (DSPM) (excluding anchors and chains, which will be left in situ) • Anode skids • Flowline transition guide base. The well plug and abandonment activities are due to commence in Quarter 3 2021, with removal of the majority of the subsea infrastructure including that listed above to follow, pending NOPSEMA acceptance of the revised EP. **Remaining Subsea Infrastructure covered by the Decommissioning EP** In addition to the infrastructure to be completely removed noted above and covered by a separate EP, the following subsea infrastructure is proposed to be decommissioned and left on site on the sea floor as is under the Decommissioning EP: • DSPM anchors and chains • Umbilical crossing mattresses • Umbilicals and umbilical jumpers • Flexible and reinjection flowlines and jumpers. Further information on the Decommissioning EP infrastructure to be left in situ is in **Table 1**. Please refer to the end of this document to see actual photos of the infrastructure that is proposed to be left in situ. **Table 1: Summary of Subsea Infrastructure covered by the Decommissioning EP** **Infrastructure** / **Description** DSPM anchors and chains — Six (6) anchors weighing approximately 35 Te each, and six (6) anchor chains Umbilical crossing mattresses — Eight (8) umbilical crossing mattresses Umbilicals and umbilical jumpers — Ten (10) umbilicals and umbilical jumpers up to approximately 5.8 km in length Flexible and reinjection flowlines and jumpers — Four (4) flowlines 2-1/2 inch to 6 inch and 1700 to 5750 m in length. Four (4) jumpers 2-1/2 inch to 6 inch and 17 to 50 m. Four (4) risers 6 inch and 2-1/2 inch 1035 to 1045 m in length. In addition to the infrastructure noted above, Eni are proposing to leave the Corkybark wellhead in situ. Approval for this will be sought through the P&A and Equipment Removal EP; however, details of this wellhead have been included in this factsheet as stakeholders have not previously been provided with relevant information on it. The Corkybark wellhead is located at 114.9736806, -20.8928668 and sits approximately 1m above the seabed. **Activities** There are NO ACTIVITIES to be undertaken as part of the scope of the Decommissioning EP, see below in **Table 2**.

Table 2: Summary of Activities in scope of Decommissioning EP

Activity	Summary	Frequency and duration
Permanent Decommissioning in situ	All subsea infrastructure within the scope of this EP is proposed to be decommissioned in situ. No vessel activities or removal activities are within the scope of this EP. All infrastructure has been flushed and cleaned under separate EPs.	Not applicable, no infield activities planned

Comparative Assessment

A comparative assessment process was undertaken to inform the decommissioning activities. This included evaluation of a range of decommissioning options for the Woollybutt infrastructure, including complete removal, partial removal and leave in situ the remaining subsea equipment. Options were assessed with respect to technical, health and safety, environmental, economic and socioeconomic risks.

The assessment has determined that leaving the remaining components in situ would provide the best overall outcome. In particular, the equipment would continue to provide hard substrate for marine habitat growth on an otherwise featureless seabed.

Eni have commissioned studies to inform and support the leave in situ decommissioning option for certain remaining subsea infrastructure, including

- Degradation studies that assess how the infrastructure will react in the marine environment and to understand potential long term impacts; and
- Fish habitat studies to assess the habitat supported by the remaining Woollybutt field infrastructure and to inform the assessment of long term benefits to benthic habitats.

The preliminary findings of these studies will be available in the Decommissioning EP submitted to NOPSEMA. Once approved, the Decommissioning EP will be published in full on the NOPSEMA website. Eni is happy to share this information with commercial fishers prior to NOPSEMA publication, if you would like to receive a copy of these preliminary findings please contact Eni (details below).

Environmental Management

Eni assessed the environmental risk assessment for the proposed decommissioning activities. Management measures will be implemented to reduce the impacts and risks to as low as reasonably practicable and to an acceptable level.

Table 3 provides a summary of potential key environmental risk and/or impacts to commercial fishers and associated management measures identified.

Table 3: Potential Key Environmental Risks and Management Measures

Environmental Risk and/or Impact	Risk Description
Interaction with other marine users	Leaving certain subsea infrastructure in situ will result in a long term physical presence on the seabed. This has potential to interact with other marine users, particularly those who have activities that also interact with the seabed. A potential snag risk. These potential impacts will be assessed in the decommissioning EP and will include mitigation measures such as long term identification of infrastructure on marine charts.
Discharge of material to the marine environment	Long term degradation of subsea infrastructure may occur, releasing materials that include micro and macro plastic. Degradation modelling shows that the infrastructure is expected to self bury between 60-90% within 30 years of decommissioning and will take up to 10,000 years to fully degrade. The Decommissioning EP will assess the potential impacts to the marine environment, marine mammals and key indicator

Stakeholder	Consultation Bulletins
	species from the breakdown of these plastic and other materials. At the time of abandonment none of the infrastructure is expected to contain any liquid chemicals.
	Benefits to benthic habitats: Observations of the Woollybutt infrastructure indicate that benthic habitat has become established. This is expected to provide ongoing benefits to benthic habitats in the Woollybutt field area. Fish habitat studies are underway to quantify the benefit that the long term presence of the subsea infrastructure may have on benthic habitats and an assessment of this will be provided in the Decommissioning EP. Preliminary results have identified habitat for the following commercial species: *E. areolatus* (Aerolate Grouper), *L. malabaricus* (Saddletail Snapper) and *G. buergeri* (Northern Pearl Perch). It has also been found that 100 % of the Corkybark wellhead is covered in marine growth comprising 40% soft growth and 60% hard growth.
	Commercial Fishing Stakeholder Comment and Feedback As a relevant and potentially affected party to the Decommissioning EP, your comment as a commercial fisher is sought in relation to any potential impact that the proposed decommissioning activities, covered by the Decommissioning EP, may have on your functions, interests or activities. If you wish to provide any feedback, please do so by COB Friday 30th April 2021 to the contact details provided below. All comments provided will be considered and included in the Decommissioning EP to be submitted to NOPSEMA, in accordance with the OPGGS Act. All communications in relation to this should be directed to: Email: [redacted] Post: [redacted] [redacted] Phone: [redacted] Yours sincerely
Mackerel Managed Fishery (Area 2) **Onslow Prawn Managed Fishery** **Pilbara Trap Managed Fishery** **Pilbara Trawl Interim Managed Fishery** **Pilbara Line Fishery**	**01.04.2021 – Email sent by WAFIC on behalf of Eni** Dear Commercial Fisher Eni Australia Limited (Eni) is currently planning and working on the decommissioning of the Woollybutt field, Eni is seeking your feedback as a stakeholder and potentially affected party with interests in this area. Please find in the attached fact sheet more information on the project activities. The focus of this consultation is the permanent abandonment of some infrastructure on the sea floor, for which a new environment plan (EP) titled 'Woollybutt Field Decommissioning EP' is being prepared (referred hereafter as the Decommissioning EP). **Location:** Approximately 80 km north of Onslow and 40 km west of Barrow Island. **Water Depth**: Approximately 100 m. **Previous Activity Update:** • Plug and abandon all wells and remove a large amount of the site infrastructure planned for Q3 2021-2022. • These activities have been previously communicated to you and the relevant EP is currently with NOPSEMA for assessment. **Activity Overview – Decommissioning EP:** The remaining Woollybutt infrastructure is planned to be decommissioned in situ (permanently left as is on the sea floor) and will be covered under the Decommissioning EP. It is the retiring of the remaining infrastructure and leaving this on site that Eni is specifically seeking your feedback on. The Decommissioning EP involves zero activity at the Woollybutt site.

Stakeholder	Consultation Bulletins
Western Tuna and Billfish Fishery **Australian Southern Billfish Fishery** **Australian Southern Bluefin Tuna Industry Association** **Tuna Australia**	The infrastructure that is proposed to be left in situ includes: • Disconnectable single point mooring anchors and chains • Umbilical crossing mattresses • Umbilicals and umbilical jumpers • Flexible and reinjection flowlines and jumpers • Corkybark wellhead **Potential impacts to commercial fishers:** The attached factsheet contains further information on the decommissioning activities as well as more information on each of the points below: • The remaining infrastructure will be between 0.3m and 1m above the seabed with the Corkybark wellhead being the highest piece of infrastructure. o Potential snag hazard • This infrastructure provides benthic habitat. o Fish aggregation site o See sub-sea photos in the attached fact sheet • Eni have commissioned fish habitat surveys, preliminary results have identified habitat for the following commercial species: E. areolatus (Aerolate Grouper), L. malabaricus (Saddletail Snapper) and G. buergeri (Northern Pearl Perch). • Eni have commissioned degradation studies to understand how the left behind infrastructure will react in the marine environment following decommissioning. o Made predominantly of steel and plastic, it is expected that the plastics will take 1,000 to10,000 years to degrade o 60% to 90% of the infrastructure is expected to self-bury within 30 years of decommissioning, which will mean some plastics will remain buried whilst others will over time enter the marine environment as microplastics and macroplastics o Long term degradation of subsea infrastructure may occur, especially micro and macro plastic o The Decommissioning EP will assess the potential impacts to the marine environment, marine mammals and key indicator species from the breakdown of these plastic and other materials **Exclusion Zones:** • All prior petroleum safety exclusion zones will be removed from the Woollybutt site. • All remaining infrastructure will remain marked on navigation charts. WAFIC is sending this information out (via a blind email) on a fee-for-service basis on behalf of Eni to ensure commercial fishing license holders receive this in a timely manner via an accurate list. Eni needs your feedback. If you have any additional queries please contact [redacted] directly (on behalf of Eni) via: [redacted] or [redacted]. Best regards [redacted] **Attachment:** **Woollybutt Field Decommissioning Environment Plan (EP) Commercial Fishing Stakeholder Consultation** **Introduction** Eni Australia Limited (Eni) is currently planning the decommissioning of the Woollybutt field in Production Licence WA-25-L. This involves the preparation of the Woollybutt Field Decommissioning Environment Plan (EP) to be submitted to the National Offshore Petroleum Safety and Environmental Management Authority (NOPSEMA) covering the subsea infrastructure that remains in the Woollybutt Field – referred in this document as the Decommissioning EP. Eni seeks to engage directly with the commercial fishing sector and looks forward to your comment and input regarding Eni's final plans for the decommissioning of the Woollybutt Field. The Woollybutt field is 65 km north of Onslow and 35 km west of Barrow Island, in approximately 100 m water depth. See map on page 6. Decommissioning activities are planned in three stages, summarised below: **Activity** | **Key Approval Document** | **Status**

Stakeholder	Consultation Bulletins

4. Plug and abandonment (P&A) of wells	P&A and Equipment Removal EP	Consultation done, EP assessment in process.
5. Removal of the majority of Woollybutt subsea infrastructure		
6. Leaving of the remaining subsea infrastructure in situ.	Decommissioning EP	EP under preparation – subject of this consultation

Activity 1 and Activity 2 noted above covers the physical infrastructure removal activities for the Woollybutt site and is going through the NOPSEMA approval process through a separate EP.

The Decommissioning EP involves zero activity on site. Eni is seeking NOPSEMA acceptance of the Decommissioning EP which involves leaving all remaining infrastructure in situ (ie left as is).

The decommissioning strategy has been selected by Eni following comparative assessment of all decommissioning options. The assessment found that leaving certain elements of the subsea infrastructure in situ provided better environmental, technical and safety outcomes than complete removal, partly due to the presence of subsea habitats that have formed on the infrastructure since it was first installed.

Background

Woollybutt oil production ceased in 2012 and all associated subsea infrastructure has remained in situ while decommissioning activities were planned for.

Since production ceased, field maintenance and management activities have been ongoing in accordance with a long standing EP, which was last revised and accepted in 2019 (https://info.nopsema.gov.au/activities/28/show_public).

Diagrams of the Woollybutt infrastructure field Figures 1 – 3 are on pages 7 - 9.

This **P&A and Equipment Removal EP** also covers plug and abandonment (P&A) activities and is currently being revised to include the complete removal of the majority of the Woollybutt field subsea infrastructure including:

- Wellheads and Xmas trees (except the Corkybark wellhead, which will be left in situ)
- Subsea manifolds
- Subsea umbilical termination units
- Umbilical termination assembly
- Control distribution unit
- Disconnectable single point mooring (DSPM) (excluding anchors and chains, which will be left in situ)
- Anode skids
- Flowline transition guide base.

The well plug and abandonment activities are due to commence in Quarter 3 2021, with removal of the majority of the subsea infrastructure including that listed above to follow, pending NOPSEMA acceptance of the revised EP.

Remaining Subsea Infrastructure covered by the Decommissioning EP

In addition to the infrastructure to be completely removed noted above and covered by a separate EP, the following subsea infrastructure is proposed to be decommissioned and left on site on the sea floor as is under the Decommissioning EP:

- DSPM anchors and chains
- Umbilical crossing mattresses
- Umbilicals and umbilical jumpers
- Flexible and reinjection flowlines and jumpers.

Further information on the Decommissioning EP infrastructure to be left in situ is in **Table 1**. Please refer to the end of this document to see actual photos of the infrastructure that is proposed to be left in situ.

Table 1: Summary of Subsea Infrastructure covered by the Decommissioning EP

Infrastructure	Description
DSPM anchors and chains	Six (6) anchors weighing approximately 35 Te each, and six (6) anchor chains

Stakeholder	Consultation Bulletins

Umbilical crossing mattresses	Eight (8) umbilical crossing mattresses
Umbilicals and umbilical jumpers	Ten (10) umbilicals and umbilical jumpers up to approximately 5.8 km in length
Flexible and reinjection flowlines and jumpers	Four (4) flowlines 2-1/2 inch to 6 inch and 1700 to 5750 m in length. Four (4) jumpers 2-1/2 inch to 6 inch and 17 to 50 m. Four (4) risers 6 inch and 2-1/2 inch 1035 to 1045 m in length.

In addition to the infrastructure noted above, Eni are proposing to leave the Corkybark wellhead in situ. Approval for this will be sought through the P&A and Equipment Removal EP; however, details of this wellhead have been included in this factsheet as stakeholders have not previously been provided with relevant information on it.

The Corkybark wellhead is located at 114.9736806, -20.8928668 and sits approximately 1m above the seabed.

Activities

There are NO ACTIVITIES to be undertaken as part of the scope of the Decommissioning EP, see below in **Table 2**.

Table 2: Summary of Activities in scope of Decommissioning EP

Activity	Summary	Frequency and duration
Permanent Decommissioning in situ	All subsea infrastructure within the scope of this EP is proposed to be decommissioned in situ. No vessel activities or removal activities are within the scope of this EP. All infrastructure has been flushed and cleaned under separate EPs.	Not applicable, no infield activities planned

Comparative Assessment

A comparative assessment process was undertaken to inform the decommissioning activities. This included evaluation of a range of decommissioning options for the Woollybutt infrastructure, including complete removal, partial removal and leave in situ the remaining subsea equipment. Options were assessed with respect to technical, health and safety, environmental, economic and socioeconomic risks.

The assessment has determined that leaving the remaining components in situ would provide the best overall outcome. In particular, the equipment would continue to provide hard substrate for marine habitat growth on an otherwise featureless seabed.

Eni have commissioned studies to inform and support the leave in situ decommissioning option for certain remaining subsea infrastructure, including

- Degradation studies that assess how the infrastructure will react in the marine environment and to understand potential long term impacts; and
- Fish habitat studies to assess the habitat supported by the remaining Woollybutt field infrastructure and to inform the assessment of long term benefits to benthic habitats.

The preliminary findings of these studies will be available in the Decommissioning EP submitted to NOPSEMA. Once approved, the Decommissioning EP will be published in full on the NOPSEMA website. Eni is happy to share this information with commercial fishers prior to NOPSEMA publication, if you would like to receive a copy of these preliminary findings please contact Eni (details below).

Environmental Management

Eni assessed the environmental risk assessment for the proposed decommissioning activities. Management measures will be implemented to reduce the impacts and risks to as low as reasonably practicable and to an acceptable level.

Table 3 provides a summary of potential key environmental risk and/or impacts to commercial fishers and associated management measures identified.

Stakeholder	Consultation Bulletins

Table 3: Potential Key Environmental Risks and Management Measures

Environmental Risk and/or Impact	Risk Description
Interaction with other marine users	Leaving certain subsea infrastructure in situ will result in a long term physical presence on the seabed. This has potential to interact with other marine users, particularly those who have activities that also interact with the seabed. A potential snag risk. These potential impacts will be assessed in the decommissioning EP and will include mitigation measures such as long term identification of infrastructure on marine charts.
Discharge of material to the marine environment	Long term degradation of subsea infrastructure may occur, releasing materials that include micro and macro plastic. Degradation modelling shows that the infrastructure is expected to self bury between 60-90% within 30 years of decommissioning and will take up to 10,000 years to fully degrade. The Decommissioning EP will assess the potential impacts to the marine environment, marine mammals and key indicator species from the breakdown of these plastic and other materials. At the time of abandonment none of the infrastructure is expected to contain any liquid chemicals.
Benefits to benthic habitats	Observations of the Woollybutt infrastructure indicate that benthic habitat has become established. This is expected to provide ongoing benefits to benthic habitats in the Woollybutt field area. Fish habitat studies are underway to quantify the benefit that the long term presence of the subsea infrastructure may have on benthic habitats and an assessment of this will be provided in the Decommissioning EP. Preliminary results have identified habitat for the following commercial species: *E. areolatus* (Aerolate Grouper), *L. malabaricus* (Saddletail Snapper) and *G. buergeri* (Northern Pearl Perch). It has also been found that 100 % of the Corkybark wellhead is covered in marine growth comprising 40% soft growth and 60% hard growth.

Commercial Fishing Stakeholder Comment and Feedback

As a relevant and potentially affected party to the Decommissioning EP, your comment as a commercial fisher is sought in relation to any potential impact that the proposed decommissioning activities, covered by the Decommissioning EP, may have on your functions, interests or activities. If you wish to provide any feedback, please do so by COB Friday 30th April 2021 to the contact details provided below.

All comments provided will be considered and included in the Decommissioning EP to be submitted to NOPSEMA, in accordance with the OPGGS Act.

All communications in relation to this should be directed to:

Email: [redacted]

Post: [redacted]

[redacted]

Phone: [redacted]

Yours sincerely

[redacted]